DOCUMENT RESUME

ED 063 792 EM 010 008

AUTHOR	Dunn, Thomas G.
TITLE	The Effects of Various Review Paradigms on Performance in an Individualized Computer-Managed Undergraduate Course.
INSTITUTION	Florida State Univ., Tallahassee. Computer-Assisted Instruction Center.
SPONS AGENCY	Office of Naval Research, Washington, D.C. Personnel and Training Research Programs Office.
REPORT NO	TR-22
PUB DATE	31 Aug 71
NOTE	99p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Academic Performance; Anxiety; *College Students; *Computer Assisted Instruction; *Individualized Instruction; Interval Pacing; Multiple Choice Tests; *Review (Reexamination); Self Pacing Machines; Study Skills; Time Factors (Learning)

ABSTRACT

The effectiveness of reviews was investigated in an individualized, self-paced computer-managed instruction (CMI) course. It was hypothesized that students receiving reviews, which were either multiple-choice questions with feedback or short paragraphs, would perform better than students receiving no reviews, and that students receiving two reviews would perform best. A total of 124 students enrolled in an 11-module health education course participated as subjects. All subjects were given pretests and posttests, as well as a test to determine the value of reviews, a questionnaire about pacing strategies, an anxiety measure, and a student attitude toward CMI questionnaire. Subjects were randomly assigned to one of four treatments: a distributed review group with two reviews on each of the first five modules evenly spread across the course; a pseudo-distributed group with the same reviews, all completed before the end of the sixth module; a massed late review group with the same review materials all in one session; and a control group. Results of analyses of the data indicated that reviews did not significantly contribute to performance, that consistent pacers performed better, and that subjects receiving question reviews had lower anxiety scores than those receiving short paragraphs. (SH)

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THE EFFECTS OF VARIOUS REVIEW PARADIGMS ON PERFORMANCE IN AN INDIVIDUALIZED COMPUTER–MANAGED UNDERGRADUATE COURSE

Thomas G. Dunn

Tech Report No. 22
August 31, 1971

Project NR 154-280
Sponsored by
Personnel & Training Research Programs
Psychological Sciences Division
Office of Naval Research
Arlington, Virginia
Contract No. N00014-68-A-0494

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The results for several dependent measures indicated that reviews did not significantly facilitate retention. In addition, the review treatments did not differ among themselves with respect to format and placement variables. It was concluded that the reviews should be more comprehensive and greater in number. In addition, since these improved reviews would take more time, they should be presented to those students who demonstrate a need for review. In this manner, Computer-Managed Instruction could remain cost-effective.

The results of the pacing analyses revealed that Ss who paced consistently performed significantly better than Ss who massed their coursework. In addition, for one performance measure (TPT1) a pacing by amount of review interaction was found indicating that the amount of review did not contribute to the performance of consistent pacers but did contribute to the performance of nonconsistent pacers. It was suggested that further research be conducted to determine if pacing does in fact affect performance and also, that pacing may provide information about those students who may have the greatest need for reviews.

With respect to affective measures, there was a significant main effect for the state anxiety data with Ss receiving question reviews having lower state anxiety scores than Ss receiving paragraph reviews. It was concluded from these results that planning reviews similar in format to a subsequent performance test may result in lower state anxiety while taking this test.

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THE EFFECTS OF VARIOUS REVIEW PARADIGMS ON PERFORMANCE IN AN INDIVIDUALIZED COMPUTER–MANAGED UNDERGRADUATE COURSE

Thomas G. Dunn
The Florida State University

ABSTRACT

The objective of this study was to investigate how to plan reviews within an individualized self-paced undergraduate course.

The students who enrolled in Health Education 319 for the Spring Quarter, 1971, served as subjects in this experiment. This course was conducted utilizing the student interactive capability of Computer-Managed Instruction at the Florida State University Computer-Assisted Instruction Center. The following specific questions were investigated: (a) will reviews facilitate retention; (b) which review format will be more effective, objective questions or paragraph-like statements; (c) how will the placement of reviews affect retention; (d) what will be the effect of student pacing on performance, with or without reviews; and (e) how will students react (state anxiety and attitude) to the changes in course procedures which result from including reviews within the course.

The results for several dependent measures indicated that reviews did not significantly facilitate retention. In addition, the review treatments did not differ among themselves with respect to format and placement variables. It was concluded that the reviews should be more comprehensive and greater in number. In addition, since these improved reviews would take more time, they should be presented to those students who demonstrate a need for review. In this manner, Computer-Managed Instruction could remain cost-effective.

The results of the pacing analyses revealed that Ss who paced consistently performed significantly better than Ss who massed their coursework. In addition, for one performance measure (TPT1) a pacing by amount of review interaction was found indicating that the amount of review did not contribute to the performance of consistent pacers but did contribute to the performance of nonconsistent pacers. It was suggested that further research be conducted to determine if pacing does in fact affect performance and also, that pacing may provide information about those students who may have the greatest need for reviews.

With respect to affective measures, there was a significant main effect for the state anxiety data with Ss receiving question reviews having lower state anxiety scores than Ss receiving paragraph reviews. It was concluded from these results that planning reviews similar in format to a subsequent performance test may result in lower state anxiety while taking this test.

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INTRODUCTION

A major goal of instruction is the optimum retention of the learning material. One of the most popular methods which teachers have used in order to insure retention is to schedule reviews. These actions seem appropriate since research has indicated that reviews do facilitate retention (Ausubel, 1968).

With the recent emphasis on the design and planning of individualized instruction, it would seem logical that procedures concerning reviews could be systematically planned. This planning should provide for decisions about whether or not to review, how much to review, when to review, and what format the review materials should take. In addition, since a good number of individualized courses allow students to self pace, the plans should also reflect a consideration of the possible relationship between placement of reviews and student pacing. A final consideration should be the reaction of students to the course alterations which would result from these reviews.

Although reviews have been found to facilitate retention, these research studies have involved only short reading passages (Gay, 1970). At the present time, there is no research which indicates how reviews should be incorporated within individualized instruction.

Recent work at the Florida State University Computer-Assisted Instruction Center with Computer-Managed Instruction (CMI) may provide a vehicle through which to answer these questions about reviews. The present study investigated how to include reviews within an individualized computer-managed course. This involved a study of (1) the value of different amounts of review, (2) the most effective format for review materials, (3) the optimum placement of reviews within the course,(4) the effect of student pacing, and (5) how students feel about the alterations in course format which result from the addition of review material. Background information about CMI in addition to a review of the research pertaining to the questions cited above, are presented in the literature review.

LITERATURE REVIEW

The order to be followed in the literature review will be as follows: (1) Computer-Managed Instruction; (2) Effect of Reviews on Retention; (3) Temporal Placement of Reviews; (4) Format of Review Materials; (5) Pacing; and (6) Affective Measures.

Computer-Managed Instruction. Several large scale projects involving individualized instruction have found the computer to be a valuable aid in managing the instructional process. Some of the more notable of these are the Program for Learning in Accordance with Needs (Flanagan, 1969), the Individually Prescribed Instruction/Management and Information System (Cooley & Glaser, 1968), and the Instructional Management System (Silberman, 1968). In each of these systems, there are common elements which can be described in a summary statement.

All of these systems specify units of instruction with stated objectives. Each student takes a pretest which is read by an optical scanner and scored by the computer. Based on the program logic, the student is then assigned to specific learning tasks Either the computer makes this decision or the information is given to the teacher who makes the decision. The student's progress towards the objectives is assessed at various points within the unit; decisions are made to allow the student to continue or provide remedial exercises. When the student completes the assigned tasks, he takes a criterion-referenced posttest. This test is also scored by computer. If the student does not reach criterion, remedial procedures can be assigned. If criterion is achieved, the student can proceed to the next unit. Either the computer makes these decisions or provides information to the teacher who makes the decisions.

This type of instructional system is referred to as Computer-Managed Instruction (CMI) or a Computer-Based Instructional Management System (CBIMS). Hansen (1970) lists five functions which characterize an ideal CMI system: (1) providing diagnostic evaluations with learning prescriptions; (2) counselling students about adaptive learning strategies and appropriate career development; (3) developing an optimal scheduling system to match students with learning resources; (4) maintaining an appropriate student instructional-record system; and (5) the limited use of CAI for drill and practice.

The distinctive characteristic of CMI at the Florida State University CAI Center is the utilization of a student-terminal interaction capability (Gallagher, 1970; Hagerty, 1970; Lawler, 1971). In general, these CMI courses are divided into learning modules which include objectives, references, and evaluation measures. A student usually chooses his own sequence and paces himself through the course. A reference list is available for each objective and the actual learning materials are available in the CAI Center. When a student feels he has sufficiently studied the references to enable him to reach an objective, he comes to the CAI Center, where he interacts with the computer for individual evaluation. The computer records and scores the test responses and can allow the student to progress to the next module, can require more evaluation, or can provide remedial prescriptions. Thus, while the instructional design involved in these CMI courses is similar to the CMI projects already discussed, it is the immediate computer decisions imparted to students in the form of feedback and/or remedial activities which constitute

the major advantages of CMI at Florida State. Students are also able to discuss any problems or ask questions of the teacher or graduate assistants working with the course.

The most extensive of these CMI courses, in terms of the number of students processed, is the undergraduate Health Education course, which is required of all FSU elementary education majors. The first field test of this course demonstrated some problems which will constitute part of the background of this paper. Lawler (1971) compared three different methods of progressing through the CMI Health Education course. In addition, a fourth group received the traditional classroom instruction. The three CMI methods were: (1) **Forced Progression** - the student proceeded to the next module no matter how she performed in CMI testing. No remedial exercises were prescribed; (2) **Remedial Prescription Forced Progression** - if a student failed to reach criterion, she was given a remedial prescription but proceeded to the next module without retesting; (3) **Remedial Prescription Forced Mastery** - if a student failed to reach criterion she was given a remedial prescription and then had to reach criterion on that objective before proceeding to the next module.

While the Remedial Prescription-Forced Mastery group did significantly better than the Forced Progression group, the other comparisons, (1) Remedial Prescription-Forced Mastery vs. Remedial Prescription-Forced Progression, and (2) Remedial Prescription-Forced Progression vs. Forced Progression, were not significantly different. Lawler offered possible explanations for the lack of demonstrated advantages of mastery and remedial prescriptions. First of all, many Ss did not study off-line before retesting and second, there was no assurance that Ss performed the activities specified in the remedial prescriptions before returning to CMI testing. Lawler (1971) recommended that on-line reviews presented automatically at specific points in the course might be a solution to this problem.

The student-terminal interactive capability of these CMI courses would be especially useful in studying the effect of reviews for the following reasons: (1) through individual interaction, the computer could systematically control the presentation of a number of review paradigms and maintain the integrity of their presentation for different groups, and (2) it would allow for the processing of a large number of students and the systematic management of their progression through the course.

The Effect of Reviews on Retention

Research has consistently demonstrated that reviews do facilitate the retention of related materials such as written prose (Peterson, Ellis, Toohill, Kloess, 1935; Tiedeman, 1948; Reynolds & Glaser, 1964; and Ausubel & Youssef, 1965). With materials such as nonsense syllables, the frequency of repetition rather than spacing of review or practice seems to be the most important factor in retention (Pratt, 1936; Peterson, 1956; Korn & Lindley, 1963; Bushke & Lim, 1967). Reviews have also been found to facilitate the retention and use of mathematical rules (Gay, 1970). In addition to establishing the value of reviews many investigators have found two reviews to be more effective than a single review (Peterson, et al, 1935; Tiedeman, 1948; and Gay, 1970).

The present study included an investigation of the advantage of one review over none and the advantage of two reviews over one.

Temporal Placement of Reviews

Research has also focused on the problem of where to place reviews. Peterson,

et al., (1935) found that an early or late review was equally effective when retention was measured on the 10th and 21st days after original learning. Sones and Stroud (1940) found a small tendency (nonsignificant) for rereading review to become more effective as the reviews were placed further away from original learning and closer to the criterion test. However, a review in the form of an objective test had a significant opposite effect; that is, decreasing value from "early" to "delayed." In both of the previous studies, the criterion test was given to all groups an equal number of days after original learning. Therefore, there was a greater time interval between early review and retention test than between the delayed review and the retention test.

Ausubel (1966) controlled for this methodological problem by varying the interval between original learning and review. In this way a review session constituted an early or delayed review for different groups, and the interval between last review and criterion test remained the same for both groups. With these altered experimental conditions, Ausubel found no difference in retention between an early and a delayed review. Ausubel explained this result by suggesting that the advantages of early and delayed review counterbalanced each other. In an early review, the learner has another opportunity to acquire meanings in the material which he partially or completely missed on the first trial. In addition, the early review has a consolidating effect on recently learned material while it is still highly available. That is, the learner can confirm correct meanings, clarify ambiguities, and indicate areas of difficulty which will require concentrated study. On the other hand, in a delayed review the learner is more highly motivated. He has forgotten some material and realizes that the review is not superfluous. Also, prior forgetting enables the learner to become more aware of areas of instability, confusion, and lack of discriminability. Therefore, during the delayed review he can purposefully take steps to strengthen these weak components. Ausubel concluded that an early and a delayed review provide distinctive functions and that they could be profitably combined.

In an experiment involving the effect of spaced reviews on mathematical rule learning, Gay (1970) found evidence to support Ausubel's contention. In this experiment, a group which had an early and a late review performed better on a delayed retention test than a group which had two early reviews and another group which had two delayed reviews. Therefore, the question of temporal placement would be important in incorporating reviews in an instructional design. Another important factor would be the format of the review materials themselves.

Format of Review Materials

In practically all of these studies the review had been in the form of a relearning session. During relearning Ss reread the entire learning passage which was limited to a few pages. Relearning reviews have been successful in increasing retention (Peterson, et al., 1935; Ausubel & Youssef, 1965; and Ausubel, 1966). An exception to the relearning review was the Reynolds and Glaser (1964) study, in which definitions of important terms in programmed learning material were repeated at various points in the learning sequence. This review covered only a small portion of the original learning materials, yet did facilitate retention on several performance measures.

Another form of review has been the objective testing review session. These review sessions have been multiple-choice questions on the learning passage. Research

has indicated that testing reviews have been more effective when given shortly after original learning but lose their effectiveness as the review occurs further away from original learning (Spitzer, 1939; Sones & Stroud, 1940; Tiedeman, 1948). A testing review was also found to be effective in the retention of mathematical rules (Gay, 1970). However, this review was actually a combination of contingent testing and relearning, since it involved solving a problem according to a mathematical rule. If the student could not solve the test problem, the steps involved in its solution were demonstrated. In this way the student could "relearn" the rule.

Students spend relatively little time interacting with the computer in a CMI situation. In this manner, large numbers of students can be processed. Therefore, if reviews are to be included in the instructional design and presented to students on line, they must be relatively brief in order to be economically feasible. Thus, the most popular form of review found in the research literature, i.e., a total rereading-relearning session, would not be acceptable within this CMI framework. However, formats which take much less time, such as objective testing, and/or which involve only a limited amount of reading, such as the review used in the Reynolds and Glaser study (1964), could be utilized for reviewing substantial amounts of course material in CMI. The present study will contrast two review formats; (1) an objective testing format, and (2) brief definitions or explanations (paragraph length) pertaining to important concepts within the instructional modules.

Pacing

Research evidence, in general, supports the conclusion that distributed practice is more effective than massed practice for both learning and retention (Gordon, 1926; Ausubel, 1968). Practice in this sense refers to repeated presentations of the same task. This advantage of distributed practice is much more conclusive for the learning of skills (DeCecco, 1968) and certain verbal learning situations (Underwood, 1961) than for instructional materials. In other words, while it is believed that consistent pacing over an entire course would be better than massing at the end, there is no research on which to base this conclusion.

Consistent pacing over an entire course would imply a "rest" or "integration" period between instructional modules. Ausubel (1968) gives several reasons to justify this integrative period: (1) sufficient time is necessary to recover from initial learning shock before proceeding to new tasks; (2) adequate time is provided for contemplating the material in retrospect, for effecting integrative reconciliation, and for conducting adequately spaced reviews; and (3) excessive cognitive strain and a feeling of harrassment are avoided.

The data from the first field test (Lawler,1970) of the Health Education course provided information which was relevant to the question of pacing. From the total number of students, it was possible to establish two groups which differed in pacing strategy. In the distributed pacing group (DP) were those who completed at least one module in each of nine weeks or more, while not completing more than three modules in any one week. A massed pacers group (MP) included students who completed six or more modules in one week, or a total of nine in any two consecutive weeks. The performances of these groups were compared for several performance measures. The DP group consistently performed better than the MP group, with pretest and final test comparisons significant at the .01 and .05 levels, respectively.

FORMAL STATEMENT OF THE PROBLEM

The review of the literature clearly indicates that reviews have been effective in facilitating retention. However, this effectiveness has not been established for individualized, self-paced instruction. Therefore, this study included an investigation of the value of a review vs. no review and, in addition, the value of two reviews vs. one review.

The on-line interactive capability of CMI at Florida State University affords an ideal opportunity to study the effectiveness of reviews since the presentation of a variety of review paradigms can be controlled within the course structure. Three of these paradigms are concerned with the temporal placement of reviews. However, the question of temporal placement of reviews is confounded by student pacing. That is, the temporal nature of a review is in essence controlled by the pacing of the student. This situation makes the comparison of the different temporal placement strategies most difficult. In an attempt to solve this problem, temporal placement was considered more a massed versus distributed variable, with levels of this variable being descriptive of typical student strategies. In a post-analysis, if sufficient numbers of students had paced themselves consistently, the experimental design allowed for an investigation of the temporal placement factor.

Another independent variable was the format of review material, with reviews being short conceptual paragraphs and multiple-choice questions.

The specific research hypotheses evaluated were:

(1) Students receiving reviews will perform better than students receiving no reviews.

(2) Students receiving two reviews will perform better than students receiving one review.

The research literature on reviews is fairly conclusive about format and placement variables. However, since this study involved a considerable amount of learning material in a self-paced course and not just a brief reading passage, it was felt that predictions of outcomes with regard to these variables could not have been made. Likewise, predictions of outcomes in the form of research hypotheses were not made for anxiety and attitude variables since research in these areas is not conclusive. Instead, this research study attempted to answer the following specific questions:

(1) Will a distributed review be more effective than a massed review when the effectiveness of each is based on the results of a test administered after the last module?

(2) Which review format will be more effective, short conceptual paragraphs or multiple choice questions?

(3) How will student pacing strategy affect performance with and without reviews?

(4) How will the various review procedures affect the students' attitude towards computer-managed instruction?

(5) How will the various review procedures affect the students' state anxiety?

METHOD

Subjects

A total of 124 Ss (121 females, 3 males) participated in this experiment. This total represented the number of students who enrolled in Health Education 319, for the Spring Quarter, 1971.

Description of the Course

Health Education 319, the Health Program in the Elementary School, deals primarily with the fundamental components of all elementary health programs: health education, health services, and a healthy school environment. This course has three broad purposes: (1) it aims toward helping prospective elementary teachers recognize more clearly their roles, responsibilities, and opportunities for protecting and improving the health of their elementary school pupils; (2) it offers the information needed to provide an effective health services and healthful school living program in those schools in which they are to serve in the future; (3) it concerns itself with developing understanding and skill in teaching methods, source materials, and necessary content material to help elementary teachers contribute effectively toward immediate health improvement and future health maintenance of the pupils under their direction.

The course was divided into 11 modules of instruction. Each module covered a distinct area within Health Education. These modules differed in size depending on the number of objectives. Figure 1 shows the subject matter and the number of objectives for each module.

Module Name	No. of Objectives
School Health	3
Vision	3
Hearing	2
Sex Education	3
Mood Modifiers	2
Growth and Records	1
Mental Health	1
Communicable Diseases	2
Dental Health	2
Special Topics	2
Nutrition	2
Total	23

Figure 1.--Module subject matter and the number of objectives.

For this experiment, all students followed the same sequence through the course as depicted by the sequence of modules in Figure 1. The sequence was controlled by the computer, which presented only that module which was sequentially appropriate.

Students were instructed to follow the same procedures on all modules: (1) read the objectives carefully; (2) study reference materials for each objective within that module; (3) schedule time at the CAI Center for evaluation on that module. Evaluation sessions consisted of five multiple choice items for each objective within

that module. If a student answered correctly at least four of the five questions for each objective, she "successfully" completed that module and proceeded to the next one, if desired.

If the **S** missed more than one question on an objective, she did not reach criterion and was presented with a prescription which suggested remedial activities. The prescriptions were presented by the computer, or the **S** was directed to the proctor who issued the appropriate prescription. An example of such a prescription is shown in Figure 2.

CDO100

1. Know the meaning of the following words and phrases
   - pathogens
   - phagocytes
   - antibodies
   - antigens
   - germs
   - toxins
   - antitoxins
   - artificially acquired active immunity
   - naturally acquired active immunity
   - passive immunity
   - PPD

2. Know at approximately what age children should be immunized against diphtheria, whooping cough, tetanus, and polio.

3. Know the ways one acquires immunity to diseases.

Figure 2.--Prescription given to Ss who do not reach criterion for Objective 1 in the Communicable Disease Module.

Ss did not have to reach criterion on a module. Therefore, after the remedial prescription they proceeded to the next module.

The following materials were distributed to students:

1. A student guide which contained an introduction to the course, directions on how to use the computer terminal, and a list of modules and objectives with appropriate references. Appendix A shows a sample page in this guide.
2. A student digest which included required readings not in the course text.

There were no required classes to attend. However, attendance at a midweek discussion session was required unless the student had reached criterion for all objectives within the module being discussed that week.

The order followed in these discussions was the same as the order listed in Figure 1.

Description of Review Materials

The experimental groups in this study received reviews of the first five modules either in the form of multiple-choice questions with feedback or short paragraphs (a

control group did not see any reviews). The multiple-choice review questions were items which Ss had not seen on other tests. However, they did cover the same key concepts within each objective that the other tests measured. Feedback as to correctness or incorrectness of response was provided. If the incorrect choice was made, the S was informed of the correct response. In addition, both review formats included references to appropriate source materials. There were a total of 52 review units. This number consisted of four units for each objective in the first five modules.

The short paragraphs matched the multiple-choice questions in content as much as logically possible. Figure 3 shows a sample multiple-choice question and the corresponding short paragraph. Many of the paragraph reviews were a restatement of the stimulus and response in the corresponding review question. However, when logic warranted that a review would have been incomplete without the information from a distractor in the review question, this information was included. For example, in Figure 3, the paragraph review included information about the entire Snellen fraction and not just the denominator.

In addition to controlling content in the reviews, an attempt was made to evaluate their ability to stand alone as useful explanations.

Objective III--Review Question

I. In the Snellen test what does the denominator in the fraction represent?

a) That rays of light reflected at the distance in the denominator are nearly parallel.
b) the number of feet separating the child from the chart.
c) the number indicating the line of smallest letters that the child can read without a mistake at that distance.
d) the percentage of "normal vision" which the child scored.

(From Wheatley & Hallock, 1965, p.399)

Objective III--Review Paragraph

I. In the Snellen test, the acuteness of vision is expressed by a fraction.

a) The numerator of this fraction corresponds to the number of feet separating the child from the chart.
b) The denominator corresponds to the number indicating the line of smallest letters that the child can read without mistake at that distance.

(From Wheatley & Hallock, 1965, p.399)

Figure 3--An example of a review question and the corresponding review paragraph for the module on Vision.

The criteria for evaluating the reviews were adapted from Meehan's evaluation schema (1968). The following criteria scheme was utilized:

1. Scope--what range of events does the review include? Is it wide enough to be of value, yet limited enough to avoid imprecision?
2. Reliability--will the event, relationship, or situation specified in the review be maintained in repeated observations?
3. Validity--does the review contain valid information?
4. Purposeful--will the information in the review enable the user to achieve some specific objective?

A team of content experts evaluated the paragraph reviews (see Appendix B). It was hoped that such a procedure would aid in the future development of review materials.

Performance Measures

Pretest. This test consisted of four items for each objective. Three of these items came from the pool of items which were available for the computer-managed testing. The other item was unique to the pretest. Three alternate forms of the pretest were used. The alternate forms were developed by Raynor (1971) from an initial pool of items as reported by Lawler (1971). All forms were randomly distributed to Ss at the first class session for administration.

Posttest. This test was identical to the pretest and served as a final exam for the course. The three alternate forms were used. Raynor (1971) reported means of 74.3, 75.6, and 77.8 for these alternate forms with a previous Health Education course.

Temporal Probe Test. This is an additional measure which was administered to all Ss twice. Temporal Probe Test I (TPTI) was administered after Ss finished the sixth module. At this point in the course, one group had been presented with two review sessions on each of the first five modules (all 52 review units); another group had had one review session on each of the first five modules (26 review units); still

another group had not had any reviews. The purpose of TPT1 was to answer questions concerning the value of a review versus no review, the value of two reviews versus one, and which review format is more effective. Temporal Probe Test 2 (TPT2) was administered after Ss finished the last module. The purpose of TPT2 was to answer questions about the distribution of reviews, the effect of reviews on performance, and the relative effectiveness of review formats. TPT2 was important since it allowed an assessment of treatment effects before Ss studied for the final exam.

These two tests were alternate forms, consisting of two items for each of 13 objectives. Half the items were multiple choice, coming from the CMI pool, and half were constructed response. The TPTs covered only the first five modules, since these were the modules which had been reviewed.

Strategy Questionnaire. This is a self-report measure developed and first used by Lawler (1971). Its purpose was to compare actual pacing with self-reported pacing. In Form A of this questionnaire (Appendix C) Ss responded to questions about their typical strategy in meeting course requirements. This form was administered at the same session as the pretest. Form B (Appendix D) included the same questions, but asked Ss to describe their strategy in meeting the course requirements of Health Education 319. Form B was administered at the same session as the posttest.

Affective Measures

Five-item A-State Inventory. This self report anxiety measure was administered after each temporal probe test. The instructions asked Ss to express how they felt while taking the test which they had just completed. This five-item scale was developed by Spielberger, Gorsuch, and Lushene (1971). Alpha reliabilities ranging from .81 to .89 have been reported in a series of studies using this scale (O'Neil, 1970; Lawler, O'Neil, & Hansen, 1970; Leherissey, O'Neil, & Hansen, in press). (See Appendix E.)

Student Attitude Toward CMI. This questionnaire was developed by Brown (1966). It was originally intended to measure attitude towards CAI, but has been adapted to measure attitude towards CMI. This questionnaire was administered after each temporal probe test. Brown reported a KR_{20} reliability estimate of .89 for this instrument. (See Appendix F.) Hagerty (1970) reported a reliability estimate of .88 for a group of students in a CMI class in Programmed Instruction.

Procedure

Ss who enrolled in the course were randomly assigned to one of four groups.

1. Distributed Review group (DR). These Ss were presented with two review sessions on each of the first five modules. These review units were distributed evenly over the length of the course, with five sessions in the first half of the course and five sessions in the last half.
2. Pseudo-Distributed Group (PD). Ss in this group were presented with the same review materials as the DR group, but the sessions were arranged in such a manner that they were completed when Ss went through the sixth module.
3. Massed Late Review Group (ML). These Ss were presented with the same review materials as the other two groups. However, the materials were presented in one comprehensive review session, before Ss went through the last module.
4. Control Group (C). This group did not receive any reviews.

TABLE I

Modules Which Were Reviewed, Their Placement Within the Course for DR, PD, and ML Groups, the Number of Review Items, and the Placement of TPT1 and TPT2 Within the Course

Before testing on these modules		Reviews of these modules were scheduled . . .					
		DR Group Review		PD Group Review		ML Group Review	
Units	Units	Units	No. of Units	Units	No. of Units	Units	No. of Units
School Health	1						
Vision	2	1	6	1	6		
Hearing	3	2	6	1,2	12		
Sex Education	4	3	4	2,3	10		
Mood Modifiers	5	4	6	3,4	10		
Growth and Records	6	5	4	4,5,5	14		
							TPT1
Mental Health	7	1	6				
Communicable Dis.	8	2	6				
Dental Health	9	3	4				
Special Topics	10	4	6				One massed review all 52 units
Nutrition	11	5	4				
							TPT2

Table I shows the modules which were reviewed, the number of review items, and at what place in the course each of the DR, PD, and ML groups received these reviews. Table I lists the modules in the left column, numbered from I to II. Before testing on these modules, reviews were scheduled for the DR, PD, and ML groups. For example, Ss in the DR group reviewed module I before testing on module 2; reviewed module 2 before testing on module 3; etc. The **No. of Review Units** column indicates how many review paragraphs or questions were presented during that particular review session. Therefore, Ss in the DR group automatically received 6 review questions or paragraphs on the learning material in module I (School health) immediately before going through the normal computer-managed testing for module 2 (Vision). Likewise, Ss in the PD group automatically received 10 review questions or paragraphs on the learning material in modules 3 and 4 immediately before going through the normal computer-managed testing for module 5. In addition, Table I also indicates where the TPTs were administered. Each of the groups receiving reviews were randomly divided into two subgroups:

1. Group receiving Question Reviews (QR)
2. Group receiving Paragraph Reviews (PR).

Figure 4 provides for a better understanding of the course procedures. This figure depicts the progression of a S in the DR group through the course.

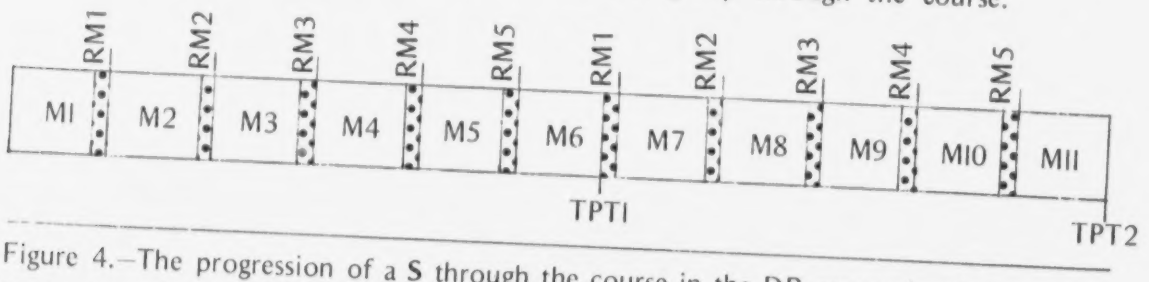

Figure 4.—The progression of a S through the course in the DR group showing module sequence, review schedule, and placement of TPT's.

Each block represents a visit to the CAI Center for module evaluation. MI through MII represent modules I through II. The shaded areas in each block represent review sessions. RMI is a review on module I, RM2 is a review on module 2, etc. The figure also shows that TPTI was administered after module 6 and TPT2 was administered after module II.

Upon completion of the sixth module the computer presented a statement to the S directing her to see the proctor. The proctor then administered the TPTI, the 5-item STAI, and the attitude questionnaire. When the S completed this test battery, she was then able to go on to the seventh module. Ss were instructed that the results of these tests would not count in their grade, but that the TPTI might help to point out areas where they needed some additional study.

All modules had to be completed two days before the end of the quarter. On the next day all Ss took the TPT2, the 5-item A-STAI, and the attitude questionnaire. Ss were instructed that the results of these tests would not count in their grade, but that the TPT2 might serve as a diagnostic indication of what needed to be studied for the final. However, feedback as to performance on the TPTs was not available to

Ss until after the final exam. (The E did not use the terms TPT1 and TPT2 when discussing these tests with the students.)

All Ss took the final exam (posttest) at the regularly scheduled time during examination week. At this time Ss also completed Form B of the Strategy Questionnaire.

Experimental Design

The experimental design had been planned to answer a variety of questions. Table 2 presents a 2 x 3 design, format of review by placement of review.

TABLE 2
Experimental Design, Format of Review by Placement of Review

DR		PD		ML		
QR	PR	QR	PR	QR	PR	
1 Review Session per module		2 Review Sessions per module				TPT1
1 Review Session per module					Massed Review	TPT2

The levels of the format variable were: question reviews (QR) and paragraph reviews (PR); while the levels of the placement variable were: distributed reviews (DR), pseudo distributed reviews (PD), and a massed late review (ML). The design indicates that when the TPT1 was administered, Ss in the DR group had had one review session on the first five modules; the PD group had had two reviews on the first five modules; and the ML group had not had any reviews. When Ss took TPT 2, all groups had had two review sessions on each of the first five modules (all 52 review units).

RESULTS

The results section has been divided into nine major subsections. In the first subsection, the overall means, standard deviations, and reliability coefficient estimates of the major dependent variables are reported; second, the analyses pertaining to the Pretest are reported; third, the analyses of the Final exam; fourth, the TPTI analyses; fifth, the TPT2 analyses; sixth, the analyses pertaining to Total Module Performance scores; seventh, the state anxiety analyses; eighth, the attitude analyses; and ninth, the analyses for the pacing data.

Means, Standard Deviations and Reliability Estimates of the Major Dependent Variables

This section presents summary statistics on the performance and affective measures administered to Ss during the Health Education course. These statistics are presented to show equivalency of the parallel forms of the Pretest and Final exams as well as the internal consistency of the dependent measures. Table 3 includes the sample size, mean, standard deviation, and reliability coefficient for the following: Pretest - total, Pretest - lst five modules, TPTI, TPT2, Final - total, Final - lst five modules, Anxiety I (TPTI), Anxiety II (TPT2), Attitude I (TPTI) and Attitude II (TPT2). The table also includes data for the three alternate forms of the Pretest and Final (x, y, and z). The data pertaining to the first five modules has been included because these are the modules which were reviewed.

As can be seen in Table 3, the Pretest reliability coefficients were greater than the corresponding coefficients for the final test. Also,the reliability coefficients for the total Pretest and Final scores. for all forms, were greater than the reliability coefficients for the first five module scores. This would be expected since the latter were shorter tests. The reliability coefficients for the TPT's were relatively low, due in part to their being one third the length of the final exam. The anxiety and attitude reliabilities were high, in all cases .90 or above.

Pretest Analyses

The data in Table 3 indicate that there were only slight differences among the three alternate forms of the Pretest; form x (30.40), form Y (30.54), and form z (31.73). A one way ANOVA comparing these forms yielded an F less than one indicating that there was no significant difference among the alternate forms. Additional analyses were employed with the combined alternate forms to compare the different treatment groups and control group on the Pretest. A 2 x 3 ANOVA with format of review (questions - QR and paragraphs - PR), and placement of review (distributed DR, pseudo distributed - PD, and massed late - ML) as the independent variable and score on the Pretest as the dependent variable was used to analyze the treatment groups. Table 4 shows the means and standard deviations for the treatment groups and the control group on the Pretest. Included in this table are total scores and scores on the first 5 modules.

No significant differences were found for either main effects or the interaction when analyzing total Pretest scores. Likewise, no significant differences were found for either main effects or the interaction for the first five modules scores.

Since this factorial design did not include the control group, the variable of review format was collapsed and a one way ANOVA comparing groups DR, PD, ML

TABLE 3

Descriptive Statistics of Major Dependent Variables

Measure	Sample Size	Highest Possible Score	Mean	Standard Deviation	Reliability Coefficient
PRETEST					
form x-total	42	92	30.40	10.95	.88
form x-5 mod.	42	52	17.38	6.11	.77
form y-total	43	92	30.54	10.27	.86
form y-5 mod.	43	52	18.07	6.45	.79
form z-total	40	92	31.73	11.17	.88
form z-5 mod.	40	52	18.63	6.94	.83
FINAL					
form x-total	39	92	69.90	8.18	.81
form x-5 mod.	39	52	39.77	4.62	.68
form y-total	37	92	75.16	6.33	.72
form y-5 mod.	37	52	43.24	3.91	.62
form z-total	43	92	73.65	9.04	.86
form z-5 mod.	43	52	41.72	5.14	.75
TPT 1	120	32	19.49	3.90	.65
TPT 2	119	32	16.31	3.94	.54
ANX I(TPT1)	118	20	12.77	4.24	.90
ANX II(TPT2)	117	20	11.33	4.21	.90
ATT. I(TPT1)	118	200	127.39	20.94	.92
ATT. II(TPT2)	117	200	124.80	22.05	.93

TABLE 4

Means and Standard Deviations for Treatment Groups and Control Group on Pretest, Total, and First 5 Module Scores

Group	Question Reviews 1st 5 mod.	Question Reviews Total	Paragraph Reviews 1st 5 mod.	Paragraph Reviews Total
DR	(N=15)		(N=17)	
Mean	32.33	17.93	33.18	18.82
SD	8.94	5.02	10.17	6.15
PD	(N=15)		(N=16)	
Mean	27.93	16.53	30.13	17.56
SD	9.68	6.91	11.84	6.38
ML	(N=17)		(N=15)	
Mean	28.82	17.00	34.40	19.87
SD	12.10	7.16	11.01	6.91

C	1st 5 mod. (N=30)	Total
Mean	30.13	18.23
SD	10.98	7.14

and C was used to analyze the Pretest for both first five module and total scores. The results of these analyses were both non significant with F ratios less than one in each case. Therefore, there was no apparent difference among these groups on the Pretest.

Analyses of Final Examination

The final examination was administered to all Ss at the prescribed time established by the University. By this time the treatment groups had received the 52 review units while the control group had not seen any review material. The Final exam data previously reported in Table 3 indicated that the means for the alternate forms on the final were: form X = 69.90, form Y = 75.16, and form Z = 73.65. In a one way analysis of variance, with the alternate forms as the three levels of the independent variable, and the score on the Pretest as the dependent variable, the F ratio (3,144) was nonsignificant.

Table 5 shows the means and standard deviations for the treatment groups and control group on the final examination, including first five modules and total scores.

An 2 x 3 ANOVA, with format of reviews (questions and paragraphs) and placement of reviews (distributed, pseudo distributed and massed late) as the independent variables, and score on the Final exam as dependent variable, was used to analyze the treatment group data depicted in Table 5. This analysis was performed for first five modules and total scores. The results of these analyses are shown in Tables 6 and 7.

TABLE 5

Means and Standard Deviations for Treatment Groups and Control Group on the Final Exam Both 1st 5 Module and Total Scores

Group		Question Reviews 1st 5 Mod	Question Reviews Total	Paragraph Reviews 1st 5 Mod	Paragraph Reviews Total
DR		(N=13)		(N=17)	
	Mean	42.15	74.31	40.29	71.29
	SD	5.70	9.82	5.30	7.32
PD		(N=13)		(N=16)	
	Mean	42.31	73.15	42.19	72.75
	SD	3.61	7.11	4.61	7.88
ML		(N=15)		(N=14)	
	Mean	40.80	72.07	41.07	71.43
	SD	4.69	7.25	5.85	10.04

C		1st 5 Mod (N=31)	Total
	Mean	41.94	71.55
	SD	4.59	15.75

TABLE 6

Analysis of Variance, Format by Placement for First Five Module Scores on the Final Exam

Source	df	MS	F
A (format)	1	.53	.02
B (placement)	2	14.46	.57
AB	2	9.42	.37
ERROR	82	25.22	

As can be seen from Tables 6 and 7, the results for both first five module and total scores were nonsignificant, with F ratios for main effects and interaction all less than one. Thus, based on final test results, it cannot be concluded that there was any differential effectiveness among the treatment groups.

TABLE 7

Analysis of Variance, Format by Placement
for Total Final Exam Scores

Source	df	MS	F
A (format)	1	2.95	.04
B (placement)	2	3.46	.05
AB	2	15.24	.22
ERROR	82	68.26	

The factorial analyses did not include a comparison with the control group. In order to determine if groups with reviews performed better than the control group, a one way ANOVA was performed which included the distributed - DR, pseudo-distributed PD, and massed late - ML review groups, collapsed over the format factor, with the control group. These groups served as four levels of the independent variable and the score on the final as the dependent variable. An analysis was performed for both first five module and total scores. The results are shown in Tables 8 and 9, respectively. Again, the F ratios in both cases were less than one, indicating that Ss with reviews did not perform better than Ss without reviews.

TABLE 8

One Way ANOVA, With Four Levels of Placement Factor
for 1st 5 Module Scores on Final Exam

Source	df	MS	F
Between groups	3	11.88	.50
Within groups	115	23.70	

TABLE 9

One Way ANOVA, With Four Levels of Placement
Factor for Total Scores on the Final Exam

Source	df	MS	F
Between groups	3	8.68	.08
Within groups	115	114.69	

Analyses for Temporal Probe Test I (TPTI)

A review of the experimental design (Table 2) indicates that when the TPTI was administered, the DR group had received one review for each of the first five modules, the PD group had received two reviews for each of the first five modules, and the ML group had not seen any reviews. The TPTI was therefore employed to investigate an amount of review factor, with two levels: PD - two reviews; DR - one review; and the format factor with two levels, questions and paragraphs. Table 10 shows the means and standard deviations for these treatment groups plus the ML and control group which did not see any review material.

TABLE 10

Means and Standard Deviations for Amount of Review by Format of Review Groups Plus the ML and C Group Data

Group	Question Reviews	Paragraph Reviews
PD - 2 rev.	(N=13)	(N=16)
Mean	20.39	20.13
SD	3.02	5.35
DR - 1 rev.	(N=13)	(N=17)
Mean	20.69	19.18
SD	3.82	3.26
ML - no rev.	(N=30)	
Mean	18.38	
SD	3.59	
C - no rev.	(N=31)	
Mean	19.65	
SD	3.98	

The data for the amount of review (2 reviews, and 1 review) by format of review (questions and paragraphs) groups were included in a 2 x 2 ANOVA with amount of review and format of review as the independent variable and score on the TPT1 as the dependent variable. The results of this analysis are shown in Table II.

The results of this analysis was nonsignificant for both main effects and the interaction with F ratios in all cases less than one. Therefore, it cannot be concluded that the amount of review (one or two) accounted for any differences on the TPTI. In addition, neither review format, questions or paragraphs, was superior.

Neither the ML group nor the C group had seen any review material when the TPTI was administered. These two groups were combined into one control group (mean = 18.95) and a one way ANOVA was run collapsing over the format factor with the levels of amount of review as the independent variable (2 reviews, I review, and

none) and the score on the TPTI as the dependent variable. The results of this analysis are presented in Table I2.

The obtained F ratio was not significant, indicating that there was no difference in performance between Ss receiving reviews and Ss not receiving reviews.

TABLE 11

Amount of Review by Format of Review
ANOVA, 2 x 2, for the TPT1

Source	df	MS	F
A (amt. of review)	1	1.49	.09
B (format)	1	11.45	.71
AB	1	5.73	.36
ERROR	55	16.07	

TABLE 12

One Way Analysis of Variance, Levels
of Amount of Review for TPT1

Source	df	MS	F
Between groups	2	18.82	1.23
Within groups	117	15.27	

Analyses for Temporal Probe Test 2

As indicated in the experimental design (see Table 2) the Ss in the three placement groups had seen all 52 review units when the TPT2 was administered. The purpose of the TPT2 was to investigate the placement of reviews, specifically, distributed (DR), pseudo-distributed (PD), and massed (ML), in addition to the format factor.

The means and standard deviations for the levels of the format factor (QR and PR) and the levels of the placement factor (DR, PD, and ML) plus the control group (C) are shown in Table I3.

The data from Table I3 (excluding the control group) were included in a 2 x 3 ANOVA, with two levels of the format factor and three levels of the placement factor as the independent variables and score on the TPT2 as the dependent variable. Table I4 shows the results of this analysis.

As may be seen from Table I4, both main effects and the interaction were nonsignificant for the TPT2 data.

The previous analysis included only groups which had been presented with review material. To include the Control group in an analysis, a one way ANOVA was used to analyze the data shown in Table I3. In this analysis the placement factor was collapsed over the format factor. These three groups (distributed review,

TABLE 13

Means and Standard Deviation for the Levels of the Format and Placement Factors, Plus the Control Group, on the TPT2

Group	Question Reviews	Paragraph Reviews
DR	(N=13)	(N=16)
Mean	18.00	15.56
SD	4.58	3.74
PD	(N=13)	(N=16)
Mean	17.00	16.44
SD	3.14	4.78
M	(N=15)	(N=14)
Mean	17.93	15.57
SD	2.76	4.52
C	(N=31)	
Mean	15.48	
SD	3.31	

TABLE 14

Analysis of Variance 2 x 3, Format by Placement on the TPT2

Source	df	MS	F
A (format)	1	40.39	2.53
B (placement)	2	1.78	.11
AB	2	8.09	.50
ERROR	81	15.98	

pseudo-distributed, and massed late) were included with the control group as four levels of the independent variables, while the score on the TPT2 was the dependent variable. The results of this analysis are shown in Table 15.

The obtained F ratio for this analysis was nonsignificant indicating that the various review treatments did not enable Ss to perform better than the control group on the TPT2.

Analyses of Total Module Performance Scores

A total of 115 questions were presented to Ss during module testing sessions. The number of questions per module depended on the number of objectives in that module. The various reviews of previous modules were presented to Ss before testing on the current module. This alteration in course procedures may have had some interference effects in the performance of the treatment groups. Table 16 shows the means and standard deviations of the treatment groups and the control group for Total Module Performance scores. The mean scores represent the number correct out of a possible 115.

TABLE 15

One Way ANOVA, Placement Levels, for TPT2

Source	df	MS	F
Between groups	3	11.60	.78
Within groups	114	14.98	

TABLE 16

Means and Standard Deviations of Total Module Performance Scores for Treatment Groups and Control Group

Group		Question Review	Paragraph Reviews
DR		(N=13)	(N=17)
	Mean	87.69	84.94
	SD	11.36	8.90
PD		(N=13)	(N=16)
	Mean	88.77	88.94
	SD	6.08	9.38
ML		(N=16)	(N=14)
	Mean	87.69	85.79
	SD	10.26	12.39
C		(N=31)	
	Mean	87.81	
	SD	12.65	

A 2 x 3 ANOVA with format of review and placement of reviews as the independent variable and Total Module Performance scores as the dependent variable, was used to analyze the data for the treatment groups in Table 16. The results of this analysis are shown in Table 17.

TABLE 17

Format by Placement ANOVA, 2 x 3, for
Total Module Performance Scores

Source	df	MS	F
A (format)	1	27.01	.28
B (placement)	2	81.22	.82
AB	2	30.82	.31
ERROR	83	98.25	

This analysis yielded nonsignificant results for both main effects and the interaction, with F ratios all less than one. Thus, the various treatment conditions did not differentially affect the overall performance on Total Module Performance. In order to determine if Total Module Performance scores differed for those groups receiving reviews and the group which did not (control), a one way ANOVA was run which included groups DR, PD, ML, and C, collapsed over the format factor, as levels of the independent variable, and Total Module Performance score, as the dependent variable. The results of this analysis are shown in Table 18.

The obtained F ratio was nonsignificant, indicating that the review conditions did not significantly influence the Total Module Evaluation scores.

TABLE 18

One Way ANOVA with Levels of the Placement Factor and
Control Group for Total Module Performance Scores

Source	df	ML	F
Between groups	3	59.93	.53
Within groups	116	112.48	

Analyses for Anxiety Data

The five item STAI-A anxiety scale was administered to all Ss after both the TPTI and TPT2.

TPTI State Anxiety (ANX-I)

The analyses for ANX-I will follow the rationale used for the TPTI performance analyses. When the TPTI was administered, the distributed review group had received one review on each module, the pseudo-distributed group had received two reviews on each module, and the massed late and control groups had not had any reviews. The

means and standard deviations of all these groups for the ANX-I data are shown in Table 19.

TABLE 19

Means and Standard Deviations of Treatment Groups and Control Group for ANX-I

Group		Question Reviews	Paragraph Reviews
DR		(N=12)	(N=17)
	Mean	13.75	12.47
	SD	5.15	3.59
PD		(N=12)	(N=16)
	Mean	11.92	13.06
	SD	4.06	3.87
ML		(N=30)	
	Mean	13.40	
	SD	4.55	
C		(N=31)	
	Mean	12.13	
	SD	4.37	

The data for the PD (2 reviews) and DR (1 review) groups were included in a 2 x 2 ANOVA with amount of review and review format as the independent variables, and the ANX-I score as the dependent variable. The purpose of this analysis was to determine if the treatment groups had a differential effect on Ss' state anxiety for TPTI. The results of this analysis are shown in Table 20. As indicated, both main effects and the interaction were nonsignificant. Therefore, Ss' state anxiety was not differentially affected by the review procedures.

TABLE 20

Amount of Review by Review Format ANOVA, 2 x 2, for ANX-I Data

Source	df	MS	F
A (amt. of review)	1	5.35	.31
B (format)	1	.06	.004
AB	1	20.42	1.20
ERROR	53	17.06	

In order to compare the state anxiety of Ss who received reviews with those Ss who did not see any reviews, the massed late and control groups were combined (mean=12.77) and included in a one way ANOVA with the amount of review groups collapsed over the format factor. Therefore, this ANOVA included three levels of the independent variable (2 reviews, 1 review, and none) and the score on ANX-I as the dependent variable. The results of this ANOVA are presented in Table 21.

TABLE 21

One Way ANOVA, Amount of Review, for ANX-I Data

Source	df	MS	F
Between groups	2	1.31	.07
Within groups	115	18.31	

The obtained F ratio in this analysis was less than one, indicating that the review conditions did not cause a change in state anxiety which was different from that of the Control group. Thus, considering both analyses of ANX-I data, neither the amount of review nor format of review affected Ss' state anxiety.

TPT2 State Anxiety (ANX-II)

TABLE 22

Means and Standard Deviations of Treatment and Control Groups for ANX-II

Group		Question Reviews	Paragraph Reviews
DR		(N=13)	(N=15)
	Mean	12.54	11.47
	SD	3.95	4.12
PD		(N=13)	(N=16)
	Mean	10.08	11.88
	SD	5.27	3.58
ML		(N=16)	(N=14)
	Mean	9.38	13.07
	SD	3.85	4.25
C		(N=30)	
	Mean	11.23	
	SD	4.24	

All treatment groups (DR, PD, and ML) had received two reviews when the TPT2 was administered. The purpose of the TPT2 performance data was to study the effect of placement of review (distributed, pseudo- distributed and massed late) and the review formats. Likewise, the purpose of collecting state anxiety data at the time of the TPT2 was to study the effect of placement of review and review format on Ss' state anxiety. The means and standard deviations of all treatment groups plus the control group for ANX-II are shown in Table 22.

A 2 x 3 ANOVA with format of review (questions and paragraphs) and placement of review (distributed, pseudo-distributed and massed late) as the independent variables and ANX-II scores as the dependent variable was used to analyze the ANX-II data. The results of this analysis are shown in Table 23.

TABLE 23

Review Format by Placement of Review
ANOVA, 2 x 3, for ANX-II Data

Source	df	MS	F
A (format)	1	102.02	5.88*
B (placement)	2	28.50	1.62
AB	2	41.35	2.35
ERROR	81	17.36	

As can be seen from Table 23, only the format effect was significant with the question review group having lower state anxiety scores than the paragraph review group. It may be noted (see Table 22) that the mean state anxiety scores at the Massed Late placement condition (ML-QR=9.38 & ML-PR=13.07) contribute the major share to this difference. Also noteworthy is the slight reversal in mean state anxiety scores found at the Distributed Review placement condition (DR-QR=12.54 & DR-PR=11.47).

In order to make a comparison with the control group, the format groups were collapsed over the placement factor and included with the control group in a one way ANOVA' This resulted in three levels of the independent variable (question reviews, paragraph reviews, and the control roup). The results of this ANOVA are reported in Table 24.

TABLE 24

One Way ANOVA, Levels of Review Format
With Control Group, for ATT-II

Source	df	MS	F
Between groups	2	25.22	1.41
Within groups	113	17.91	

The obtained F ratio was nonsignificant indicating that state anxiety did not differ between those receiving reviews and those not receiving reviews.

Analyses for Attitude Data

The attitude towards CMI questionnaire was administered to Ss after both the TPTI and TPT2.

TPTI Attitude (ATT-I)

As mentioned previously, when the TPTI was administered, the pseudo distributed group had received two reviews, the distributed review group had received one review; and the massed late and control groups, none. The means and standard deviations of all groups for the ATT-I data are shown in Table 25.

TABLE 25

Means and Standard Deviations of Treatment Groups and Control Group for ATT-I Data

Group		Question Reviews	Paragraph Reviews
DR		(N=12)	(N=17)
	Mean	114.08	130.71
	SD	19.16	23.64
PD		(N=12)	(N=16)
	Mean	134.17	131.81
	SD	21.54	24.00
ML		(N=30)	
	Mean	123.27	
	SD	20.33	
C		(N=31)	
	Mean	129.81	
	SD	17.47	

The data from the DR (one review) and PD (two reviews) group were included in a 2 x 2 ANOVA with amount of review and review format as the independent variables and ATT-I scores as the dependent variable. The purpose of this analysis was to see if Ss in the treatment groups had different attitudes towards CMI. The results of this analysis, as shown in Table 26, revealed nonsignificant F ratios for the amount of review main effect, the format main effect, and the interaction. Although the DR group with one review had a substantially lower attitude towards CMI (114.08), thereby contributing to the fairly substantial F ratio of 3.09, it cannot be concluded from the analysis that attitude towards CMI differed among the treatment groups.

While the previous analysis included only groups which had received at least one review session, it was necessary to determine if attitude towards CMI would differ

between those receiving reviews and those not receiving reviews. Therefore, the massed late (ML) and control groups (C) were combined to form one large control group (mean=126.59). This group was included in a one way ANOVA with the amount of review groups, PD and DR (collapsed over the format factor) as the three levels of the independent variable and ATT-I scores as the dependent variable. The results of this analysis are presented in Table 27.

TABLE 26

A 2 x 2 ANOVA, Amount of Review by Review Format for ATT-I Data

Source	df	MS	F
A (amt. of review)	1	1,559.13	3.09
B (format)	1	706.92	1.40
AB	1	1,250.45	2.48
ERROR	53	503.97	

TABLE 27

One Way ANOVA, Amount of Review, for ATT-I Data

Source	df	MS	F
Between groups	2	616.53	1.40
Within groups	115	439.09	

The nonsignificant F ratio which resulted from this analysis indicated that the attitude towards CMI of Ss who had at least one review did not differ from Ss who had not had any reviews.

TPT2 - Attitude (ATT-II)

When the TPT2 was administered, all treatment groups (DR, PD, and ML) had received two review sessions for each of the first five modules, while the control group (C) had not seen any reviews. The purpose of the TPT2 performance data was to study the effect of placement of reviews, and also to determine which review format, questions (QR) or paragraphs (PR) was more effective. The ATT-II data was collected immediately after the TPT2 to see how these various review procedures affected the Ss' attitude towards CMI. The means and standard deviations of all treatment groups and the control group for ATT-II data are listed in Table 28.

The data for the treatment groups were included in a 2 x 3 ANOVA with review format and placement as the independent variables, and ATT-II scores as the dependent measure. The results of this analysis are shown in Table 29.

As may be seen from Table 29, the placement effect and the interaction were both significant. This analysis is graphically depicted in Figure 5 which shows that the

TABLE 28

Mean and Standard Deviations of Treatment and Control Groups for ATT-II

Group	Question Reviews	Paragraph Reviews
DR	(N=13)	(N=15)
Mean	106.15	128.27
SD	18.89	25.40
PD	(N=13)	(N=16)
Mean	136.08	133.00
SD	20.21	22.11
ML	(N=16)	(N=14)
Mean	126.00	118.43
SD	22.55	20.27
C	(N=30)	
Mean	124.20	
SD	18.90	

TABLE 29

Format by Placement ANOVA, 2 x 3, for ATT-II

Source	df	MS	F
A (format)	1	428.04	.90
B (placement)	2	2,907.35	6.04**
AB	2	1,819.09	3.78*
ERROR	81	475.42	

**p<.01
*p<.05

question review-distributed review group (QR-DR) had a substantially lower attitude than the other groups. A Duncan Multiple Range Test revealed that the only differences between pairs of means were between the QR-DR group and four other groups. This relationship is presented schematically as follows:

QR-PD	PR-PD	PR-DR	QR-ML	PR-ML	QR-DR
136.08	133.00	128.27	126.00	118.43	106.16

The means underlined by a common line do not differ while those **not** underlined by a common line are significantly different at the .05 level. Thus, the attitudes of Ss with paragraph reviews did not differ with the**various placements, but for those receiving question reviews, the** Ss who received these reviews throughout the course (distributed) had a lower attitude score thus resulting in both a placement effect and interaction.

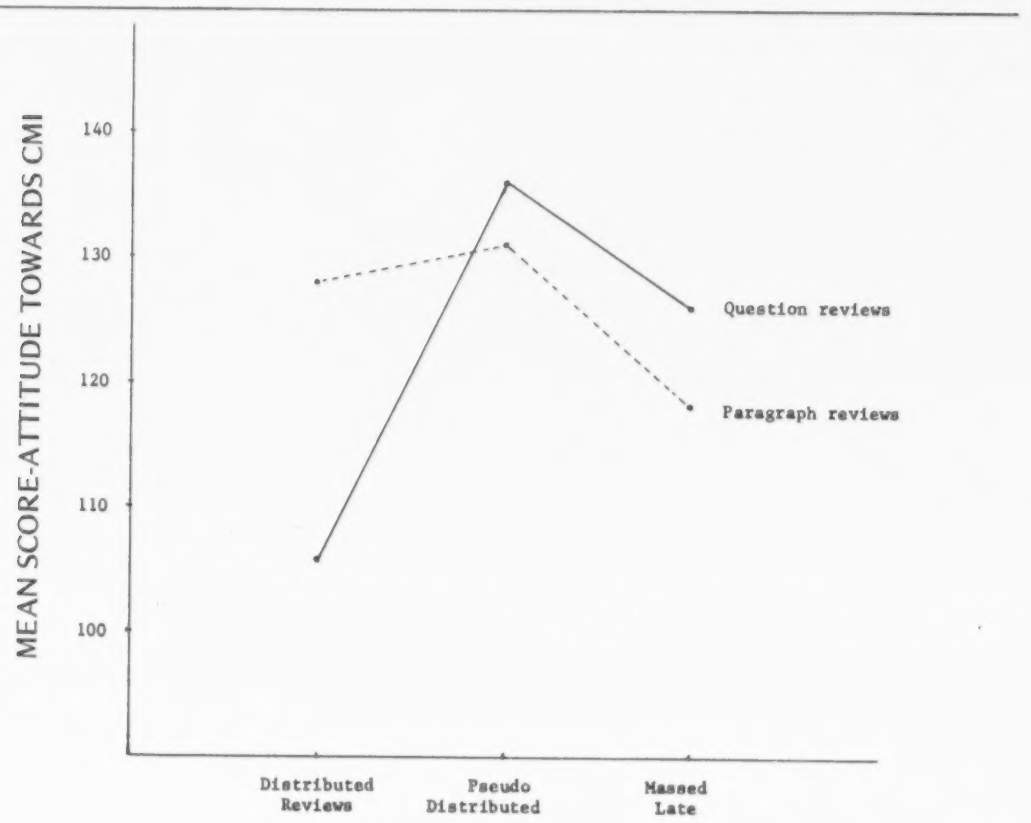

Figure 5—Format by Placement analysis of variance for attitude II

While the previous analysis was concerned with the treatment groups within a 2 x 3 design, it was still necessary to compare the treatment groups with the control group. Since there was a significant interaction, the six cells in the 2 x 3 design were not equal and therefore individual comparisons were made between each cell and the control group. First of all, a one way ANOVA was run with all seven groups (six treatment and the control) as the levels of the independent variable and the score on ATT-II as the dependent variable. The results of this analysis are shown in Table 30.

The obtained F ratio was significant indicating that there were differences among the seven groups with respect to ATT-II scores. At this point, using the error mean square (444.22) from this ANOVA, comparisons were made between each treatment group and the control group using Dunnett's test for comparing a control group with experimental groups (Myers, 1967). The only comparison which was significant was that between the control group and the question review-distributed review (QR-DR)

TABLE 30

One Way ANOVA, All Seven Groups, for ATT-II

Source	df	MS	F
Between groups	6	1338.55	3.01*
Within groups	110	444.22	

*p<.01

group. Therefore, Ss in the control group had higher attitude towards CMI scores than Ss in the QR-DR group.

Analysis of Pacing Data

As indicated in the Introduction, the temporal nature of a review would be dependent on student pacing. It was for this reason that the temporal placement of reviews was not considered as an independent variable. Instead, this independent variable was considered as disbursement or placement of reviews with levels: distributed (DR), pseudo-distributed (PD), and massed late (ML). However, the experimental design was planned in such a manner that the temporal nature of reviews could be investigated for Ss who paced themselves consistently. For these Ss, the distributed review level could be considered as an early and a late review, the pseudo- distributed level as two early reviews, and the massed late level as two late reviews.

A pacing index was utilized to characterize student pacing behavior. This index ranged from 1 to 9, indicating the number of weeks during the quarter in which a S completed at least one module. In this manner a S who completed all modules in the last two weeks would have an index of "2", while a student who completed a module each week would have an index of "9". Table 31 includes the mean pacing index and standard deviation for levels of the format factor (questions and paragraphs), the levels of the placement factor (distributed, pseudo-distributed, and massed late), and the control group.

In order to determine the relationship between pacing and performance, a series of ANOVA's were run with a pacing factor and a placement of review factor as the independent variables. This design included two levels of the pacing factor: distributed and massed. However, since the placement factor included levels with similar terminology, the levels of the pacing factor were labeled consistent and nonconsistent. All Ss with a pacing index of six or above were included in the consistent pacing group (CP); while Ss with a pacing index of five or below were included in the nonconsistent pacing group (NCP).

The design also included four levels of a placement factor collapsed over the format factor. These four levels were: distributed review-DR, pseudo-distributed-PD, massed late-ML, and the control group-C. When analyzing the TPT1, the placement factor became an amount of review factor with three levels: 2 reviews (PD group), 1 review (DR group), and no review (ML and C combined).

TABLE 31

Mean Pacing Index and Standard Deviations
for Treatment and Control Groups

Group	Question Reviews	Paragraph Reviews
DR	(N=13)	(N=17)
Mean	5.23	5.12
SD	1.58	1.99
PD	(N=13)	(N=16)
Mean	5.62	5.38
SD	1.26	1.72
ML	(N=16)	(N=14)
Mean	6.13	4.64
SD	1.56	1.45
C	(N=31)	
Mean	5.65	
SD	1.66	

The dependent measures considered in these analyses were pretest scores, final test scores (both 1st five modules and total scores), Total Module Performance scores, TPT1, TPT2, state anxiety (ANX-I and ANX-II), and attitude towards CMI (ATT-I and ATT-II). The means and standard deviations for all groups within this design for each of the dependent measures are shown in Tables 32-41.

TABLE 32

Means and Standard Deviations for Pacing
by Placement Groups on the Pretest

Group	DR Dist. Rev.	PD Pseudo Dist. Rev.	ML Massed Late	C Control
Dist. Pacing	(N=14)	(N=15)	(N=12)	(N=16)
Mean	32.14	27.53	33.92	30.94
SD	6.87	10.17	10.49	13.31
Massed Pacing	(N=14)	(N=14)	(N=17)	(N=12)
Mean	34.57	31.36	31.65	28.67
SD	11.11	11.35	12.38	8.03

TABLE 33

Means and Standard Deviations of the Pacing by Placement Groups for the 1st Five Module Scores on the Final Test

Group	DR Dist. Rev.	PD Pseudo Dist. Rev.	ML Massed Late	C Control
Dist. Pacing	(N=15)	(N=15)	(N=12)	(N=17)
Mean	43.00	42.27	43.17	42.24
SD	4.80	3.96	5.39	4.51
Massed Pacing	(N=15)	(N=14)	(N=17)	(N=14)
Mean	39.20	42.21	39.35	41.57
SD	5.57	4.44	4.55	4.83

TABLE 34

Means and Standard Deviations of the Pacing by Placement Groups for the Final Test - Total Scores

Group	DR Dist. Rev.	PD Pseudo Dist. Rev.	ML Massed Late	C Control
Dist. Pacing	(N=15)	(N=15)	(N=12)	(N=17)
Mean	76.13	72.73	75.50	75.65
SD	6.18	7.10	8.09	8.65
Massed Pacing	(N=15)	(N=14)	(N=17)	(N=14)
Mean	69.07	73.14	69.12	72.43
SD	9.15	8.00	8.08	8.51

TABLE 35

Means and Standard Deviations of the Pacing by Placement Groups for the Total Module Performance Scores

Group	DR Dist. Rev.	PD Pseudo Dist. Rev.	ML Massed Late	C Control
Dist. Pacing	(N=15)	(N=15)	(N=12)	(N=17)
Mean	89.67	90.87	93.67	91.35
SD	7.65	6.21	7.91	11.24
Massed Pacing	(N=15)	(N=14)	(N=17)	(N=14)
Mean	82.60	87.86	81.29	83.50
SD	10.95	9.48	10.34	13.32

TABLE 36

Means and Standard Deviations of the Pacing
by Placement Groups for the TPT1

Group	DR Dist. Rev.	PD Pseudo Dist. Rev.	ML Massed Late	C Control
Dist. Pacing	(N=15)	(N=15)	(N=12)	(N=17)
Mean	20.00	19.00	20.25	20.47
SD	3.14	3.02	1.87	3.81
Massed Pacing	(N=15)	(N=14)	(N=17)	(N=14)
Mean	19.67	21.57	17.06	18.64
SD	3.99	5.29	3.96	4.09

TABLE 37

Means and Standard Deviations of the Pacing
by Placement Groups for the TPT2

Group	DR Dist. Rev.	PD Pseudo Dist. Rev.	ML Massed Late	C Control
Dist. Pacing	(N=15)	(N=15)	(N=12)	(N=17)
Mean	17.67	15.27	17.50	16.18
SD	4.58	2.96	4.21	3.15
Massed Pacing	(N=14)	(N=14)	(N=17)	(N=14)
Mean	15.57	18.21	16.29	14.64
SD	3.72	4.61	3.60	3.41

TABLE 38

Means and Standard Deviations of the Pacing
by Placement Groups for ANX-I Data

Group	DR Dist. Rev.	PD Pseudo Dist. Rev.	ML Massed Late	C Control
Dist. Pacing	(N=15)	(N=14)	(N=12)	(N=17)
Mean	13.67	12.71	13.08	12.82
SD	3.56	4.29	3.47	4.05
Massed Pacing	(N=14)	(N=13)	(N=17)	(N=14)
Mean	12.29	12.62	13.82	11.36
SD	4.95	3.75	5.08	4.32

TABLE 39

Means and Standard Deviations of the Pacing
by Placement Groups for ANX-II Data

Group	DR Dist. Rev.	PD Pseudo Dist. Rev.	ML Massed Late	C Control
Dist. Pacing	(N=14)	(N=15)	(N=12)	(N=16)
Mean	12.43	12.40	10.42	12.69
SD	3.86	4.32	4.96	4.16
Massed Pacing	(N=14)	(N=14)	(N=17)	(N=14)
Mean	11.50	9.64	11.65	9.57
SD	4.24	4.22	4.15	3.82

TABLE 40

Means and Standard Deviations of the Pacing
by Placement Groups for ATT-I Data

Group	DR Dist. Rev.	PD Pseudo Dist. Rev.	ML Massed Late	C Control
Dist. Pacing	(N=15)	(N=14)	(N=12)	(N=17)
Mean	119.13	131.14	128.33	128.53
SD	17.47	22.81	13.16	18.02
Massed Pacing	(N=14)	(N=13)	(N=17)	(N=14)
Mean	128.86	136.31	120.41	131.36
SD	27.68	22.98	23.40	15.99

TABLE 41

Means and Standard Deviations of the Pacing
by Placement Groups for ATT-II Data

Group	DR Dist. Rev.	PD Pseudo Dist. Rev.	ML Massed Late	C Control
Dist. Pacing	(N=14)	(N=15)	(N=12)	(N=16)
Mean	115.07	132.13	129.08	125.38
SD	18.46	22.04	15.52	17.62
Massed Pacing	(N=14)	(N=14)	(N=17)	(N=14)
Mean	120.93	136.79	118.88	122.86
SD	30.44	20.27	24.57	20.85

While tables 32-41 included the data for the pacing by review placement ANOVA's, Tables 42-51 show the results of these analyses. The results of the 2 x 4 ANOVA with pacing and placement as the independent variables, and scores on the Pretest as the dependent variable are shown in Table 42.

TABLE 42

Pacing by Placement ANOVA, 2 x 4, for Pretest

Source	df	MS	F
A (pacing)	1	5.16	.04
B (placement)	3	113.76	.97
AB	3	70.87	.60
ERROR	106	116.68	

This analysis revealed nonsignificant results for both main effects and the interaction with all F ratios less than one. Thus, it cannot be concluded that the treatment groups differed on the pretest.

While the means and standard deviations for the first five modules and total scores on the Final Test were listed in Tables 33 and 34, respectively, the corresponding analyses are shown in Tables 43 and 44.

TABLE 43

Pacing by Placement ANOVA, 2 x 4, for First Five Module Scores of the Final

Source	df	MS	F
A (pacing)	1	127.59	5.64*
B (placement)	3	8.46	.37
AB	3	29.50	1.30
ERROR	111	22.63	

*$p < .05$

The analyses for both first five modules and total scores on the Final Exam revealed a significant pacing effect only, with the consistent pacing group performing better than the nonconsistent pacing group in both cases.

Thus, while Ss in the consistent pacing group had significantly higher Final scores than Ss in the nonconsistent pacing group, the review conditions did not differentially affect performance on these measures.

As mentioned previously, the temporal nature of a review, i.e., late, early, etc., could be considered for Ss who paced themselves consistently. The nonsignificant

TABLE 44

Pacing by Placement ANOVA, 2 x 4
for Total Scores on the Final

Source	df	MS	F
A (pacing)	1	486.03	7.55*
B (placement)	3	17.14	.27
AB	3	85.28	1.33
ERROR	111	64.37	

*$p<.01$

interactions for the Final-test analyses in Tables 43 and 44 indicated that these levels were not differentially effective for the consistent pacing group over the nonconsistent pacing group. Therefore, while it had been concluded from a previous *format* by *placement* ANOVA on the Final exam that distributed or massed reviews were not differentially effective, these latest analyses of the Final test indicate that the various *temporal* placements of reviews were also not differentially effective.

The results of the pacing by review placement ANOVA for Total Module Performance scores are shown in Table 45. This analysis also revealed a significant pacing effect with the consistent pacing group performing better than the nonconsistent pacing group. The various review treatments did not affect the Module Performance Scores, however, since the placement effect and interaction were both nonsignificant.

TABLE 45

Pacing by Placement ANOVA, 2 x 4, for
Total Module Performance Scores

Source	df	MS	F
A (pacing)	1	1688.36	17.15*
B (placement)	3	51.92	.53
AB	3	105.11	1.07
ERROR	111	98.45	

The other performance measures, TPT1 and TPT2, were also included in an analysis with the pacing factor. The means and standard deviations for the pacing by placement groups for TPT1 have already been presented (see Table 36). Since the ML and C groups had not seen any review material when TPT1 was administered, these two groups were combined for each level of the pacing factor, thereby setting up a 2 x 3 design. This design included two levels of the pacing factor (CP and NCP), and

three levels of an amount of review factor (2 reviews - PD, review - DR, and no review - ML and C combined) as the independent variables, and score on the TPT1 as the dependent variable. The results of this analysis are depicted in Table 46.

TABLE 46

Pacing by Amount of Review ANOVA,
2 x 3 for the TPT1

Source	df	MS	F
A (pacing)	1	101.69	7.13**
B (amt. of review)	2	63.62	4.42*
AB	2	66.37	4.61*
ERROR	113	14.26	

**p<.01
*p<.05

As may be seen from Table 46, both main effects and the interaction for this analysis were significant. Figure 6 gives a graphic representation of this analysis. It should be remembered that the two levels of the No Review condition, comprised of both the ML and C groups, were double the size of the other groups, thereby contributing substantially to the significant results of the analysis. A Duncan Multiple Range test yielded significant differences at the .05 level between two pairs of means: (a) between the nonconsistent pacing - 2 review group (21.57) and the nonconsistent pacing - no review grop (17.77); and (b) between the consistent pacing - no review group (20.38) and the nonconsistent pacing - no review group (17.77). Therefore, the amount of review did not affect performance for Ss in the consistent pacing group while it did affect performance for Ss in the nonconsistent pacing group.

The means and standard deviations of the pacing by review placement groups for the TPT2 have already been presented (see Table 37). When the TPT2 was administered, the distributed review, pseudo distributed, and massed late groups had received all review units, while the control group had not seen any review material. Therefore, the pacing by placement analysis for TPT2 included four levels of the placement factor. The results of this 2 x 4 ANOVA with pacing and placement as the independent variables and score on the TPT2 as the independent variable, are presented in Table 47.

The results of this TPT2 analysis were nonsignificant for both main effects and the interaction. This ANOVA was the only analysis of performance data in which the distributed pacing group did not perform better than the massed pacing group.

The means and standard deviations of the pacing by placement groups for the state anxiety (ANX-I and ANX-II) and attitude (ATT-I and ATT-II) data have already been presented in Tables 38-41. The results of the corresponding analyses for these data were the same in each case, i.e., both main effects (pacing and placement) and

the interaction were nonsignificant. The tables presenting these results are shown in Appendix G.

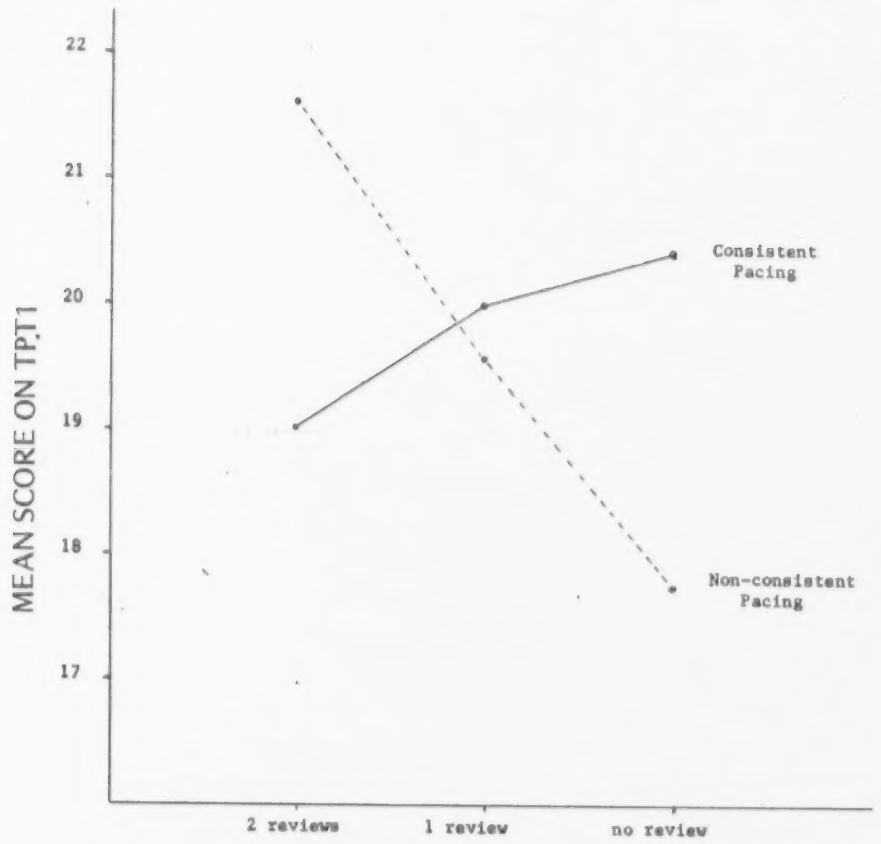

Figure 6—Pacing by amount of review analysis of variance for TPT1.

TABLE 47

Pacing by Placement ANOVA,
2 x 4, for the TPT2

Source	df	MS	F
A (pacing)	1	6.49	.45
B (placement)	3	13.94	.95
AB	3	38.73	2.64
ERROR	110	14.40	

Additional information about student pacing resulted from the analysis of the Strategy Questionnaire. As may be recalled from the Method chapter, Form A of the Questionnaire (Appendix D) was administered with the Final exam and the instructions asked Ss to indicate their specific strategies in meeting the course requirements of Health Education 319. A brief description of each of these strategies is provided below:

Strategy 1 - Puts off studying as long as possible -- procrastinates
Strategy 2 - Completes work at a steady, consistent rate
Strategy 3 - Studies only topics of interest
Strategy 4 - Studies only topics on which prior knowledge is unsatisfactory
Strategy 5 - Studies everything that is recommended, primary and secondary references.

The first two strategies were of primary interest in this study, since each was related to student pacing. That is, a student who rated high on Strategy 1 would be considered a massed pacer, while a student who rated high on Strategy 2 would be considered a consistent pacer. Correlation coefficients were calculated to determine the relationship between these two self report strategies (both forms) and actual student pacing. These results are depicted in Table 48.

TABLE 48

Correlations (r) Between Actual Pacing and Self Report Strategies 1 and 2, for Forms A and B

Form A		Form B	
Strat1	Strat2	Strat1	Strat2
-.195	.099	-.480	.491

As may be seen from Table 48, the relationship between self report strategy and actual pacing was more substantial for Form B, which was administered with the Final exam. This could indicate that the Health Education course was a new experience for most Ss and, therefore, new strategies or substantial changes in strategies resulted.

The last item in the strategy questionnaire asked Ss to select which of the five strategies was most like their own. The responses to this last item were analyzed by the Chi square method to determine if there were significant changes in strategies between Form A and Form B. In this analysis, the responses on the last item for Form A were considered as the expected frequencies; and the responses on the last item for Form B were considered as the observed frequencies. Strategies 3, 4, and 5 were combined into a single category for the Chi square analysis. This was done because these last three strategies had widely differing frequencies and combining them would not interfere with interpreting the results for the first two strategies. The contingency table depicting the expected and observed frequencies for each of the categories is presented in Table 49.

The resulting χ^2 was equal to 10.38 (df=2), which was statistically significant ($p. < .01$). This indicates that there were differences between self report typical strategies (Form A) and self report specific strategies for Health Education (Form B).

TABLE 49

Chi Square Contingency Table, Form A = Expected Frequencies and Form B = Observed Frequencies for all Groups

	Most Typical Strategy		
	1	2	3-5
Form A (expected)	30	43	47
Form B (observed)	35	26	58

DISCUSSION

In the Introduction to this paper, five general questions were presented, the answers to which were to assist instructional designers in planning reviews within individualized instruction. These questions were:

1. Would reviews facilitate retention in an individualized CMI course?
2. Which review format would be more effective, questions or paragraphs?
3. How would the placement of reviews affect retention?
4. What would be the effect of student pacing on performance?
5. How will students react (state anxiety and attitude) to the changes in course procedures which result from including reviews within the course?

Each of these questions will be discussed and recommendations will be made for future research and/or instructional planning. Since the results of the analyses pertaining to reviews and performance were non-significant, the first three questions will be discussed in the first subsection entitled "The effects of reviews on retention." The pacing results and affective student reactions will be discussed in the second and third subsections, respectively.

The Effect of Reviews on Retention

There were three dependent measures for which a comparison could be made between Ss receiving reviews and Ss not receiving reviews. These measures were: TPT1, TPT2, and the Final exam. Although the mean scores on the TPT1 and TPT2 for Ss receiving reviews were in general greater than the scores for Ss not receiving reviews, the analyses of these tests and the Final exam yielded statistically nonsignificant results. The overall conclusion from these results is that the reviews in this course did not contribute significantly to performance on the retention measures. The total mean Final exam score in this study was 72.8, while in the Raynor study (1971) the mean score was 75.8. The Health Education course in each study was essentially the same with these exceptions: (a) the module sequence was controlled in this study while students chose their own sequence in the Raynor study, and (b) Raynor allowed students to go through CMI module testing again, during the week before the final exam. Since most of the CMI questions were also on the final, it is believed that this latter exception accounted for most of the difference between mean Final exam scores.

In addition to comparisons between Ss receiving reviews and Ss not receiving reviews, other analyses of the TPT1, TPT2, and the Final exam included review format as an independent variable. It was concluded from these analyses that there was no difference in the effectiveness of the review formats. This conclusion cannot be considered definitive because of the lack of evidence in this study that reviews did facilitate retention.

Finally, the placement of reviews was considered as an independent variable in two analyses, TPT2, and the Final exam. At the time that these measures were administered, the treatment groups had received an equal number of reviews, the only difference being the placement of the reviews within the course structure. The results of analyses for both these measures showed nonsignificant main effects for placement and no format by placement interactions. Again, the conclusions from these results have to take into consideration the fact that reviews did not significantly facilitate performance on retention measures.

The over all lack of significant findings contrasts with the consistent value of reviews as found in previous research (Ausubel, 1968). As may be recalled, the review formats utilized in this study were analogous to the relatively brief reviews exemplified by objective testing units (Spitzer, 1939; Sones & Stroud, 1940; and Tiedeman, 1948) and repetitions of brief definitions (Reynolds & Glaser, 1964) which were found to be effective. However, these previous studies differed from the present study both with respect to the amount of the original learning materials involved, the comprehensiveness of reviews relative to the amount of original learning materials, and also the degree of conceptual relatedness of the learning materials.

First of all, the studies which demonstrated objective testing to be an effective review had used only a few pages of text as the learning material as opposed to several hundred in this study. Therefore, the task of selecting the appropriate course material to review in the Health Education course was vastly more difficult than the task of selecting the appropriate material to review when there were only five pages of learning material. In addition, the reviews for the Health Education course had to encompass the entire scope of the learning materials within a reasonably allowable student and computer terminal time.

A second point can be realized from considering the Reynolds and Glaser study (1964). In this study, even though the learning materials were quite substantial, i.e. over 1000 frames of programmed instruction, only the definitions of 11 terms in a subsection of this programmed materials were selected for review and the retention measure tested only these same ll terms. On the other hand, in the Health Education course, the retention measure had to cover all the learning materials but the time constraints of the CMI format precluded a direct one-to-one relationship between what was originally learned, what was reviewed, and finally, what was tested. However, this interpretation has to be tempered somewhat since it was possible to analyze only that part of the performance measure which was reviewed. When this was performed, the statistical results were the same as for the entire performance measure.

A final consideration pertains to the nature of the content material itself. Whether one considers a review as strengthening associations (Peterson, et al., 1935), or as a matter of consolidation (Ausubel, 1968) or as improving cognitive organization and search behaviors (Atkinson & Schifferen, 1969), a review does imply strengthening or improving what has already been learned. If the content material is quite extensive but conceptually related, it is at least logical to assume that a review of a limited aspect of this material may help to strengthen the interrelated aspects as well. However, in the Health Education course there were 11 modules, each covering separate and conceptually diverse content areas. In addition, the objectives within the module were at times conceptually diffuse in nature. For example, there is no logical reason to assume that reviewing the parts of the eye will also strengthen one's understanding of giving a standard eye test. Yet, both of these aspects of the learning material were included in the module on vision.

To summarize, the Health Education course includes a substantial amount of conceptually diverse learning materials and only a limited time was allocated to reviews. This contrasts with previous research reviews where the learning material was brief, conceptually related, and proportionally more time was available for reviews.

Assuming that the course content will remain eclectic in nature, the following is offered as a possible CMI solution.

It is entirely possible that an increase in both the size and number of reviews would increase retention on performance measures. This adjustment could be made contingent on performance, pacing, and other progress variables, so that only those in need of review would receive it. Thus CMI terminal time would be allocated on dynamic optimization principles so as to keep the course cost-effective. It should be added here however, that in a post-analysis situation, Ss were split into low and high groups based on Module Performance scores. Subsequent analyses revealed that reviews were not differentially effective for those in the low group.

This suggests that these reviews were ineffective and in need of revision. Thus future studies which will involve such diverse course content should first demonstrate the effectiveness of the review materials by field test procedures. During field testing the reviews could be considered as original learning materials and their effectiveness could be evaluated in a pre-posttest design. Although this procedure would not guarantee the effectiveness of these materials as reviews, it would at least demonstrate their ability to stand alone as useful content material.

Another factor which may have influenced the results was the impossibility of maintaining total control over the reviewing behavior of all students. While the integrity of the experimental review treatments was maintained, one could not prevent Ss in any group from reviewing course material on their own. Since the control group learned very quickly that they were not going to see any reviews, they, especially, may have been encouraged to review on their own.

Pacing

There were two reasons for investigating pacing in this experiment: (a) to study the temporal nature of reviews for those Ss who were consistent pacers, and (b) to determine the relationship between student pacing and performance.

With respect to those who paced consistently, the temporality of the review treatments was operational, i.e., Ss in the DR group had an early and a late review, Ss in the PD group had two early reviews, and Ss in the ML group had two late reviews. In contrast, for Ss who massed course work towards the end of the quarter, all review formats tended to be massed late. The results of the analyses pertaining to temporal placement of reviews yielded nonsignificant main effects and interactions thereby indicating that the various temporal placements of reviews were not differentially effective.

With regard to the relationship between student pacing and performance, the findings revealed that Ss in the consistent pacing group performed better than Ss in the nonconsistent pacing group on two measures, Final exam and Total Module Performance scores. This seems reasonable since Module Performance scores would better reflect a student's study habits throughout the course. If a student was "cramming" towards the end of the quarter, he would most likely hurry through the reading material and spend less time than necessary reading the most relevant information; and, in turn, this might result in poorer performance on module testing.

While the main effect of pacing was significant for the Total Module Performance scores and the Final exam, there was also a pacing by amount of review

interaction for the TPT1. It was concluded from this analysis that the amount of review did not contribute to the performance of consistent pacers while it did affect performance for nonconsistent pacers with those receiving two reviews performing better than those without reviews. This suggests that procrastinating students need reviews if they are to attain the course objectives.

The consistent differences found in the pacing analyses in this study were also found in analyzing Pretest and Final exam scores for the Lawler (1971) study. There was an exception this time, that is, no differences were found on the Pretest. If such differences were found on the Pretest, then it could be argued that pacing was a manifestation of a prior knowledge or trait characteristic. If the trait or "life style" interpretation was valid, then attempting to control or influence student pacing might not be appropriate, or worse, might even be a debilitating factor. Assuming the opposite, however, one cannot infer whether or not students will profit from controlled pacing. This remains a matter for research to determine.

The results of the significant pacing by amount of review interaction for TPT1 may provide useful information for instructional planning. If one decides not to control pacing, the problem still remains of how to improve the performance of students who mass their work and tend to perform less well than students who pace consistently. Systematically planning reviews in an adaptive model for massed pacers may solve this problem. Operationally, this would require efficient identification procedures to present these reviews to students properly labeled as massed pacers. If there had been a substantial relationship between Ss self report pacing strategy on Form A of the Strategy Questionnaire (Pretest strategy measure) and actual pacing, then the Strategy Questionnaire could have been valuable in pointing out those Ss who might need these reviews. As may be recalled, this relationship was substantial for Form B only (Final exam strategy measure). This information from Form B would be valuable in a situation where there are multiple self-paced courses. An alternate plan would be to make a determination at the mid-term point, based on actual performance, as to which Ss are nonconsistent pacers and then plan reviews accordingly.

If this adaptive type procedure is successful, then it may also solve the cost-effective difficulties of increasing the scope of review materials. That is, more comprehensive reviews can be prepared and still be cost effective if they are presented only to those who may need them.

Affective Measures

The only significant result in analyzing the state anxiety data was the format effect for the TPT2 state anxiety measure (ANX-II) with Ss who received Question Reviews having lower state anxiety scores than Ss who received Paragraph Reviews. However, the mean A-State scores for the two format groups at the distributed review level were equivalent. The results suggest that prior practice with test questions as review items may have caused Ss to have less state anxiety when going through an actual test situation. Therefore, it may be advantageous that one should plan that the reviews be similar in format to the subsequent performance measure.

Analysis of the attitude scale administered with the TPT2 (ATT-II) yielded a significant placement effect and a format by placement interaction. A Duncan Multiple Range Test indicated that the substantially lower scores of the DR-QR group accounted

for the significant placement effect and the interaction (see Figure 5). This contrasted with the anxiety data where the scores at the massed late level contributed the greatest differences. It is felt that little can be concluded from these attitude results until they can be replicated.

SUMMARY

The purpose of this study was to investigate how reviews could be incorporated within an individualized self-paced undergraduate course. In order to solve this overall problem several subordinate questions had to be answered: (a) would reviews facilitate retention in such a course; (b) which review format would be more effective, objective questions or short paragraph-like statements; (c) how would the placement of reviews affect retention; (d) what would be the effect of student pacing on performance, with and without reviews; and (e) how would students react (state anxiety and attitude) to the changes in course procedures which result from including reviews within the course.

The particular course involved was a computer-managed undegraduate Health Education course. The individual student interactive capability of CMI at Florida State University allowed for the systematic presentation of a number of review paradigms and insured the integrity of their presentation to different groups.

Analysis of the data indicated that reviews did not significantly contribute to performance on several dependent measures. In addition none of the analyses pertaining to format or placement were significant. It was concluded that the content materials in this particular Health Education course were very extensive and included too many specific facts to benefit from the relatively brief review materials. It was recommended that more comprehensive reviews which would require a great deal more time, should be presented to those students who have demonstrated a need for them.

With respect to pacing, consistent differences were found for several dependent measures with consistent pacers performing better than nonconsistent pacers in all cases. This difference was not found on the pretest. In addition, for one performance measure (TPT1) a pacing by amount of review interaction was found indicating that the amount of review did not contribute to the performance of consistent pacers but did contribute to the performance of nonconsistent pacers. It was suggested that further research be conducted to determine if pacing does in fact affect performance, and also that pacing may provide information about those students who may have the greatest need for reviews.

With respect to affective measures, there was a significant main effect for the state anxiety data with Ss receiving question reviews having lower state anxiety scores than Ss receiving paragraph reviews. It was concluded from these results that planning reviews similar in format to a subsequent performance test may result in lower state anxiety while taking this test.

REFERENCES

Ausubel, D. P. Early versus delayed review in meaningful learning. *Psychology in the Schools*, 1966, *3*, 195-198.

Ausubel, D. P. *Educational psychology: A cognitive view.* New York: Holt, Rinehart and Winston, Inc., 1968.

Ausubel, D. P., & Youssef, M. The effect of spaced repetition on meaningful retention. *The Journal of General Psychology*, 1965, *73*, 147-150.

Brown, Bobby R. An instrument for the measurement of expressed attitudes toward computer assisted instruction. In Semi-Annual Progress Report, *Experimentation with Computer-Assisted Instruction in Technical Education*. Project No. 5-85-074, prepared by Harold E. Mitzel, et al., December 31, 1966.

Buschke, H., and Lim, H. Short-term storage of repetitions of two items. *Psychonomic Science*, 1967, *7*, 277-278.

Cooley, W. W., & Glaser, R. An information and management system for individually prescribed instruction. In R. C. Atkinson & H. A. Wilson (Eds.), *Computer-assisted instruction: A book of readings*. New York: Academic Press, 1969.

DeCecco, J. P. *The psychology of learning and instruction: Educational psychology*. Englewood Cliffs, New Jersey, Prentice-Hall, Inc., 1968.

Flanagan, J. C. Program for learning in accordance with needs. *Psychology in the Schools*, 1969, *6*, 133-136.

Gallagher, P. D. An investigation of instructional treatments and learner characteristics in a computer-managed instruction course. Technical Report No. 12, CAI Center, Florida State University, July 30, 1970.

Gallagher, P.D., O'Neil, H. F., Jr., and Dick, W. Effects of trait and state anxiety on performance in a computer-managed instruction course. Paper presented at the annual meeting of the American Educational Research Association, New York, February, 1971.

Gay, L. R. Temporal position of reviews and its effect on the retention of mathematical rules. Unpublished doctoral dissertation, The Florida State University, 1970.

Gordon, K. Class results with spaced and unspaced memorizing. *Journal of Experimental Psychology*, 1925, *8*, 337-343.

Hagerty, N. K. Development and implementation of a computer-managed instruction system in graduate training. Technical Report No. II, CAI Center, Florida State University, June 30, 1970.

Hansen, D. N. The role of computers in education during the 70's. Technical Memo 15, CAI Center, Florida State University, May 1970.

Korn, J. H., & Lindley, R. H. Immediate memory for consonants as a function of frequency of occurrence and frequency of appearance. *The Journal of Experimental Psychology*, 1963, *66*, 149-154.

Lawler, R. M. An investigation of selected instructional strategies in an undergraduate computer-managed instruction course. Unpublished doctoral dissertation, The Florida State University, 1971.

Lawler, R. M., O'Neil, Jr., H. F., & Hansen, D. H. Anxiety and confidence in computer-assisted learning. Paper read at the American Educational Association Annual Meeting, Minneapolis, 1970.

Leherissey, B., Hansen, D. N., & O'Neil, H. P., Jr., Effects of memory support upon anxiety and performance in computer-assisted learning. Paper read at the American Educational Association Annual Meeting, Minneapolis, 1970. (in press). *Journal of Educational Psychology*.

Meehan, E. J. *Explanation in social science: A system paradigm*. Homewood, Illinois: The Dorsey Press, 1968.

O'Neil, Jr., H. F. Effects of stress on state anxiety and performance in computer-assisted learning. Technical Report No. 6, CAI Center, Florida State University, January 1, 1970.

Peterson, M. J. Verbal response strength as a function of cultural frequency, schedule of reinforcement, and number of trials. *The Journal of Experimental Psychology*, 1956, *52*, 371-376.

Peterson, H. A., Ellis, M., Toohill, N., & Kloess, P. Some measurements of the effects of reviews. *Journal of Educational Psychology*, 1935, *26*, 65-72.

Pratt, C. C. Repetition, motivation, and recall. *British Journal of Psychology*, 1936, 425-429.

Reynolds, J. H., & Glaser, R. Effects of repetition and spaced review upon retention of a complex learning task. *Journal of Educational Psychology*, 1964, *55(5), 207-308.*

Shiffrin, R.M., & Atkinson, R.C. Storage and retrieval processess in long-term memory. *Psychological Reviews*, 1969, *76*, 179-193.

Silbermann, H.G. Design objectives of the instructional management system. SP 3038/001/00, Systems Development Corporation, Santa Monica, Calif., 1968.

Sones, A. M., & Stroud, J. B. Review with special reference to temporal position. *Journal of Educational Psychology*, 1940, *31*, 665-676.

Spielberger, C.D., Gorsuch, R.L., & Lushene, R.E. *The state-trait anxiety inventory (Test manual).* Palo Alto, California: Consulting Psychologists Press, 1971.

Spitzer, H. F. Studies in retention. *The Journal of Educational Psychology*, 1939, *30*(9), 641-656.

Tiedeman, H. R. A study of classroom learning. *The Journal of Educational Research*, 1948, *41*, 516-531.

Underwood, B. J. Ten years of massed practice on distributed practice. *Psychological Review*, 1961, *68*, 229-247.

Wheatley, G.M., & Hallock, G. T. Health observation of school children. New York: McGraw-Hill Book Co., 1965.

APPENDICES

APPENDIX A
SAMPLE PAGE FROM STUDENT GUIDE

APPENDIX A

SAMPLE PAGE FROM STUDENT GUIDE

Module: Mood Modifiers

Introduction: The purpose of this module is twofold: First, it is intended to provide the prospective teacher with some basic information about some commonly abused drugs, and secondly, to expose you to some generally accepted principles regarding the teaching of drug education.

It goes without saying that this topic is increasing in importance at all levels of public education. It is also obvious that those individuals with a firm understanding of drugs and the consequences of drug abuse will be more effective in teach ng these concepts at any grade level.

There are 2 objectives in this module.

OBJECTIVE 1: The student should be able to identify the four major categories of drugs most commonly abused with examples of each category, as well as the specific consequences which results from the abuse of these drugs.

Sample Test Situation: The class of drugs which typically produce a dreamy, listless state of intoxication are the

1 amphetamines
2 alcohols
*3 narcotics
4 depressants

Primary References:

DIGEST: American Medical Association. *Drug Abuse*. Information Program. Fact Sheet. Chicago: AMA, 1970.

————————————————, "Leaflets," 1970.

TEXTS: Turner, C.E., Randall, H.D., & Smith, S.L., *School Health and Health Education* (6th edition). St. Louis: C.V. Mosby Co., 1970. Chapter 13.

OBJECTIVE 2: With respect to drug education, the student must identify the general content appropriate to a particular grade level, *as well as suggested methods of instruction useful in educating pupils about the range of mood modifiers.

*Note: These grade levels conform to those of the School Health Education Study (SHES) and are given in the 3M materials edited by Russell and Sliepcevich (see primary references which follow).

Sample Test Situation: The educational objective of a drug abuse program at any level of instruction - elementary, secondary, or college - is to:

1 apprise students of the moral implications of drug abuse
*2 prevent the development of an actual drug abuse situation
3 provide an opportunity for students to study drug research
4 permit students to reject drug abuse of their own volition

Primary References:

DIGEST: Council on Mental Health of the American Medical Association. Marihauna and society. *Journal of the American Medical Association*, June 24, 1968, Vol. 24, 1181-1182.

Licensed Beverage Industries, Inc., Accurate and unbiased information about alcoholic beverages is essential to the total education of youth. New York, New York.

Lewis, D. B. Drug Education: A challenge for the 70's. *Educational Product Report*. Vol. 3 No. 7, April, 1970. Pp. 2-3.

McCarthy, R. G., Let's be objective when we teach about alcohol. *Inventory*, May-June 1959, Vol. 9, No. 1.

Mullin, L.S. Alcohol education: The school's responsibility. *Journal of School Health*. October, 1968, 518-521.

Russell, R. D. & Sliepcevich, E. M. "School health education study: Instructional units." Minnesota: 3 M Company, 1968.

TEXTS: Turner, C. E., Randall, H. B., and Smith, S. L. *School health and health education* (6th edition). St. Louis: C. V. Mosby Co., 1970, Chapter 13.

APPENDIX B
EVALUATION OF PARAGRAPH REVIEWS

APPENDIX B
EVALUATION OF PARAGRAPH REVIEWS

The paragraph review items used in the Health Education course were evaluated by three persons who were familiar with the Health Education curriculum. The evaluators were presented with instructions describing what they were to do and the criteria with which they were to evaluate these review units. These instructions are presented on the following page.

As may be seen from the instructions, adding the scores for each criterion would result in a highest possible rating of 20, and a lowest possible rating of 4. The second and third criteria, i.e., reliability and validity, were seldom rated low since this would mean making incorrect statements. The first and fourth criteria had more variability and probably would not require a content expert to make the evaluation as would be the case for the reliability and validity criteria.

Following the instructions page, the reviews are presented by module, by objective. Next to each review is a number ranging between 4 and 20. This figure is the mean rating score of the review calculated from the individual scores of the evaluators. It is difficult to state which range indicates an adequate review and which range indicates an inadequate review. However, a rating below 16 implies that for at least one criterion the score was 3 or below. Since "3" is the mid point in the scale and does not imply anything positive, then it could be concluded that such a review needs to be improved. On the other hand, a rating of 18 or above implies that at least two of the criteria had the highest rating of "5" and therefore could be considered a good review.

INSTRUCTIONS FOR EVALUATING REVIEWS

You are being asked to evaluate review items used in a Health Education course. These reviews are brief definitions, explanations, etc. of important concepts within the Health Education curriculum. They have all been developed by summarizing or quoting information from the actual source material which the students were assigned.

Since the students in this course were going to spend relatively little time in direct interaction with the computer the reviews had to be brief in order to be feasible and cost effective.

The criteria for evaluating these reviews were adapted from Meehan's evaluation schema. He was evaluating an explanation in terms of the logical deductions which went into its development. Instead of evaluating the logical deductions which constituted or lead up to the "explanations" as they appear in the Health Education texts or articles, you will be evaluating the review in terms of the process of summarization, extraction, etc., which went into its formation.

The following criteria scheme will be utilized:

1) Scope--what range of events does the review include? Is it wide enough to be of value, yet limited enough to avoid imprecision?

range clearly inappropriate	1	2	3	4	5	range appropriate

2) Reliability--will the event, relationship, or situation specified in the review be maintained in repeated observations?

unreliable	1	2	3	4	5	reliable

3) Validity--does the review contain valid information?

invalid information	1	2	3	4	5	valid information

4) Purposeful--will the information in the review assist the user in achieving some specific objective?

information non-purposeful	1	2	3	4	5	information purposeful

SCHOOL HEALTH

OBJECTIVE 1

1) Within the conceptual approach to Health Education, three key concepts serve as the unifying threads of the curriculum characterizing the processes underlying health. Each of the three represents a process that is typical of every individual. These key concepts are:
    1. Growing and Developing
    2. Interacting
    3. Decision Making

17.00

2) The process of decision making is unique to man. It enables the individual to reason through life situations. Decision making is influenced continually by the processes of growing and developing and interaction. In turn it continuously influences the other two processes.

16.33

3) In the article on the Conceptual Approach to Education, a "Conceptual Framework" is described. The components and proper sequence in this framework are:

    Health
    3 Key Concepts
    Concepts
    Sub Concepts
    Long Range Goals

15.33

4) Within the "Conceptual-framework" each concept is represented by substantive elements termed subconcepts. Subconcepts serve as supporting ideas viewed in three dimensions that serve as guides in selecting and ordering the subject matter of health education. The sub-concepts might be described as the first step in the operational level of the overall conceptual framework.

16.00

OBJECTIVE 2

1) On page 149 of the Turner text several specific activities of the teacher are listed with regard to Health Education. Some of these are:
   1. Helping to maintain health records
   2. To assist in interpreting the school health program to parents
   3. Weighing and measuring students

   16.67

2) According to Turner, page 149, Health Education must remain mainly in the hands of the teacher because she is the only person with the child long enough to modify his habits and because health education is a part of general education, not a series of special lectures by a group of specialists.

   14.00

3) Concerning the observation of students by teachers, daily formal inspection has advantages and disadvantages. The primary advantage is the guarantee that children will be observed attentively for at least five minutes. However, the primary disadvantage is that this procedure may be embarrassing to the individual child. This is discussed in Wheatley p. 11.

   17.00

4) On page 8 of the Turner text several reasons are provided for having school health education. These are:
   1. Present health practices are poor.
   2. Attitude towards disease has not resulted in good hygienic living.
   3. There is a general lack of basic information about health matters.
   4. Habits affect health and schools can help to develop health habits.

   17.67

OBJECTIVE 3

1) It is considered a good idea for parents to take their children to their own physicians for periodic physical examinations instead of relying on the school for such services. The advantages of this plan are that it retains the valued individual physician-patient relationship and develops the sense of parental responsibility for such services. Turner describes this on page 137.

16.33

2) On page 153 Turner discusses the health coordinator in the secondary school. This coordinator should be a faculty member with a special background interest, and aptitude in the health field. His activities are many and time consuming. If a full time appointment is not practical, a minimum of three periods daily should be arranged for this work.

14.33

3) The six major activities of school health services, as listed by Turner on p. 132 are:

1. the health appraisal of pupils and school personnel
2. follow-up and promotion of the correction of health defects
3. the prevention and control of communicable diseases
4. the provision of special health services for exceptional children
5. the provision of emergency care in case of accident or sudden illness
6. the supervision of environmental sanitation

19.33

4) In school examinations the present tendency is to give a limited number of routine examinations to all children and to give priority to those in special need of attention. In most states the frequency of medical examinations of school children is determined by law. Many states require an examination at or just before school entrance and an examination of all children every 3 or 4 years thereafter. This is discussed by Turner, p. 133.

16.00

VISION

OBJECTIVE 1

1) There are 3 kinds of people who engage in professional eye care:

   a. Opthalomologist--formerly called oculist, is a physician licensed to treat diseases and disorders of the eye.
   b. Optometrist--examines eyes for errors of refraction in the lens system. They write 3/4 of all prescriptions for glasses in the U.S.
   c. Optician--a technician, he grinds lenses to the prescriptions of the oculist or optometrist.

   From Schifferes article in the digest. 20.00

2) A common, very annoying, infection of the external portions of the ocular system is conjunctivitis. Pink eye is a form of conjunctivitis that usually occurs in epidemic fashion. The eyes become bloodshot and inflamed, feel itchy, and irritated and often feel that something was in them.

   From Schifferes article in the digest. 17.33

3) Nearsightedness or myopia is the condition in which the eyes can focus on nearby objects but distance vision is blurred. The reason for this is almost always that the eyeball is too long in relation to its focusing power. Myopia is corrected by wearing concave lenses in glasses.

   From Schifferes article in the digest. 18.67

4) Astigmatism is a condition which produces distorted images, fuzzy and out of shape. This common but peculiar error in the refractive powers of the eye is corrected for by eyeglasses ground with compound lenses.

   From Schifferes article in the digest. 18.00

OBJECTIVE 2

This review was presented twice.

We will now review some of the most important parts of the eye.

a. the optic nerve
b. the vitreous fluid
c. the retina
d. the iris
e. the aqueous fluid
f. the cornea
g. the pupil
h. the lens

20.00

OBJECTIVE 3

1) In the Snellen Chart Test, the acuteness of vision is expressed by a fraction:
   a. The numerator of this fraction corresponds to the number of feet separating the child from the chart.
   b. The denominator corresponds to the number indicating the line of smallest letters that the child can read without a mistake at that distance.

   From Wheatley text, p. 399. 18.00

2) There are certain guidelines to use in making judgments about referral after Snellen testing. For example, if a 1st grade boy repeatedly complains of difficulty in seeing letters on a page and tests 20/20 on 2 consecutive tests for L,R, & B, he should still be recommended to a specialist because of the self report symptom.

   From Wheatley text, p. 399. 18.00

3) Concerning the guidelines for referral after Snellen testing, if a 10-year old 5th grader scores L 20/30, R 20/30, and B 20/30, you should retest. Then after retesting if the scores are the same, recommend referral to eye specialist. The practical criterion is that past the 4th grade referral should be made if the score is 20/30 or less.

   From Wheatley text, p. 399. 18.00

4) In setting up Snellen testing, the general illumination should not be less than one-fifth of the illumination of the chart. Too much light on the chart, or spot lighting of the chart, may compensate for some errors of refraction and keep them from being discovered. To avoid contrasts, no bright light should be within the child's field of vision.

   From Wheatley text, p. 402. 18.33

HEARING

OBJECTIVE 1

This review was presented twice.

This is a review of some of the important parts of the ear:

A is the pinna, its function is to gather sounds from the atomosphere
B is the eardrum or tympanum
C is the mastoid cells
D is the cochlea
E is the Eustachian tube which allows pressure to equalize on the 2 sides of the eardrum
F is the round window
G includes the malleus, incus and stapes and comprises the middle ear

OBJECTIVE 2

1) Acute or chronic mastoiditis is a serious condition which in the past nearly always required surgical intervention. Now it can usually be prevented or treated successfully with a sulfa drug or one of the antibiotics.

From Wheatley text, p. 424. 17.33

2) There are 2 types of instruments in general use for testing hearing of school children

1. phonograph speech audiometer
2. pure-tone audiometer

The pure-tone audiometer is the preferred of the two since it makes possible the detection of high frequency losses that are not revealed by the phonograph screening method.

From Wheatley text, p. 426. 18.67

3) A more serious condition than middle-ear infection is chronic inflammation of the middle ear. This condition is not accompanied by severe pain but rather keeps the membranes lining the ear in a state of constant low-grade inflammation. If the condition is not cleared up in time, progressive loss of hearing will result.

From Wheatley text, p. 423. 17.00

4) Loss of hearing may result from defect disease in any part of the auditory mechanism.

a. Most common form of hearing loss results from trouble in the sound-conducting portions of the ear.
b. Loss of hearing due to lesion of the auditory nerve is called nerve deafness.
c. Some deafness is caused by formation of spongy bone in the inner ear.
d. Congential defects can also cause deafness.

From Wheatley text, p. 424. 19.33

SEX EDUCATION

OBJECTIVE 1

1) According to the Burt and Bower article the critics of sex education generally fall into three categories:

   a. Individuals and organizations identified with the extreme right wing.
   b. Sincerely motivated but uninformed individuals who have been influenced by right wing propaganda.
   c. Well intentioned and responsible critics.

   It is the authors' contention that the vast majority fall in the first two categories.

   17.00

2) The stated goals of SIECUS (Sex Information and Education Council of the United States) are the establishment and exchange of information and education about human sexuality. This organization has actively promoted sex education in the schools. SIECUS is one of the major targets of the sex-education opponents like the John Birch Society. This is discussed in the Goodheart article in the Digest.

   18.67

3) According to the Burt and Brower article, surveys indicate that approximately one of 20 parents initiates sex education for his children. These statistics have held up even after attack from critics. The ratio, supposedly goes much higher, (1 to 60) if you ask whether parental discussion provided real guidance.

   16.67

4) The World Health Organization states that ignorance, not knowledge of sexual matters, is the cause of "sexual misadventure." Concerning the relationship between knowledge about sex and the rate of premarital pregnancies, there are limited studies which point to the direction of a decline in premarital pregnancy with the increase in knowledge about sex. However, most experts feel that not enough figures are available to justify a conclusion.

   This is discussed in the Barbara Goodheart article.

   17.33

OBJECTIVE 2

1) In the sex education program at the senior high school level, material pertaining to the psychological and social aspects of adult relationships and marriage should be given.

   This is actually a review of material already presented. However, at this point, the material would be presented in more detail and depth.

   This is discussed in the Braun article in the Digest.

   13.67

2) The following information is from Gorham's article in the Digest.

   Although "strangers" are always the culprit in child molestations, research has shown that only one in three such crimes is committed by a stranger. This fact is even more significant when it is estimated that only 20 to 50% of molestations are ever reported.

   Experts feel that warnings about sex criminals should not be part of general sex education.

   17.67

3) A sex education program should start in the kindergarten and early elementary school years with simple answers to basic biologic questions regarding health habits, growth and development, reproduction and sexual differences.

   Simplicity and straightforward answering of questions will be the key factor in facilitating more involved discussions of sex at later levels.

   Discussed in Brown's article in the digest.

   17.67

4) The junior high school is a period of growing up, a period of surging sex interests, desires, and urges. During these years these new desires must be discussed including information on necking and petting.

   It is at this time that the anatomy of sex and the reproductive organs should be described and the description of the sex act and conception.

   Discussed in the Levine article in the digest.

   15.33

OBJECTIVE 3

1) Schifferes discusses the subject of human sperm in his article on Human Reproduction in the Digest.

Very briefly, each normal human sperm consists of three parts:

a. head
b. neck
c. tail

17.67

2) The female reproductive system is discussed in the Schifferes article in the Digest.

This is a short review of the **uterus**. The uterus, or womb, is the central organ of the female reproductive system. It is held in place loosely by a number of ligaments. This permits changes in size, shape, etc. which occur during pregnancy. Two important parts of the uterus are:

a. Cervix, or neck, is at the lower narrower end of the uterus.
b. Endometrium, is the inner lining of the uterus.

17.00

3) The male reproductive system is discussed in the Schifferes article in the Digest. This is a brief review of the function of the **testes.**

Two testes are enclosed in a sac of skin, called the scrotum, suspended from the groin.

The two functions of the testes are:

a. to manufacture sperm
b. to manufacture the male sex hormone, testosterone.

18.33

4) Menstruation is discussed by Schifferes in the Digest article. This is a short review about one aspect of menstruation.

Painful menstruation or dysmennorrhea does occur. However, this has been found to be the exception, rather than the rule. This condition can often be relieved and prevented by a change in attitude toward the menstrual process. When indicated, the physician can prescribe medication for relief of menstrual pain and tension.

18.00

MOOD MODIFIERS

OBJECTIVE 1

1) Stimulants, such as amphetamines and methamphetamines, are prescribed for a limited number of medical conditions and usually for very brief periods of time. When abused, these drugs cause a rapid build-up of tolerance - that is, additional quantities are needed to achieve the same stimulating effects.

From AMA fact sheet in Digest.

18.33

2) The immediate effects of glue sniffing are similar to alchohol in that a "high" feeling results. Repeated use leads to psychic dependence but does not seem to cause physical dependence. Several deaths from suffocation have resulted from glue sniffing.

From AMA fact sheet in Digest.

17.67

3) Heroin is the narcotic most frequently abused. Its slang names are "horse," "stuff," "junk," and "smack."

Heroin has no medical use. It is important to know the slang names of the common drugs such as:

speed	mescaline
snow	cocaine
yellow jackets	barbiturates

From Turner text, p. 197.

15.67

4) All drugs produce states of intoxication but in varying degrees.
   a. narcotics generally produce a dreamy, listless state of intoxication.
   b. stimulants typically cause aggressive behavior.
   c. sedatives cause release of inhibitory control, intoxication and later drowsiness.
   d. hallucinogens act as stimulants but may also cause lethargy.

From AMA fact sheet.

19.33

OBJECTIVE 2

1) Concerning the 3M materials, at level I (k-3), teaching children the facts, evils, or the apparent values of substances adults smoke, drink, and take, can result in misunderstandings. However, through simple identification and relating these substances to some that children sometimes use for a mood change, the basis for a later understanding of the motivations for use and misuses of substances can be established.

   From 3M materials in the Digest.

2) The New York State Education Department has published an excellent program concerning drugs, alcohol, and smoking. There are three separate levels:
   Grades 4-6
   Grades 7-9
   Grades 10-12

   It is interesting to note that rehabilitation is only incorporated into the senior high level. This program is discussed in the Turner Text, p. 204.

3) With regard to the 3M materials, here are 3 behavioral objectives for Level I (Grades k-3):
   a. that the student identify substances commonly used which modify mood and behavior
   b. student names ways that common mood modifying substances are used in the home
   c. student is aware that there are differences between alcohol and other beverages.

4) The Licensed Beverages Industry has developed a series of principles concerning alcohol education:
   a. Alcohol education should have clearly defined aims and purposes.
   b. The principles of alcohol education are the same as those of all education.
   c. Materials must meet standard requirements.
   d. Teachers must be adequately trained.

   From LBI article in Digest.

APPENDIX C
FORM A OF STRATEGY QUESTIONNAIRE

APPENDIX C
FORM A OF STRATEGY QUESTIONNAIRE

Students vary considerably in the "strategies" they employ in meeting course requirements or assignments. Of course, many students use difference strategies for different types of courses, i.e., one might not study chemistry in the same manner as history.

This questionnaire describes 5 common strategies and asks you to rate yourself on each strategy as to how typical it is of your **general** strategy. Please read each carefully and respond **honestly** by **circling** the number of your choice on each scale. Your response has no bearing on your course evaluation.

Strategy 1: I usually put off all studying and/or course work as long as possible. I seem to work more efficiently when the "pressure is on" to meet an upcoming deadline. I usually procrastinate.

not at all typical 1 2 3 4 5 6 7 8 9 very typical

Strategy 2: I usually complete my course work at a steady consistent rate. I feel a commitment to work steadily week after week so that I don't ever get behind.

not at all typical 1 2 3 4 5 6 7 8 9 very typical

Strategy 3: I usually study or spend my time on only those course topics which are of interest to me. I usually do not study that material which is not of interest to me.

not at all typical 1 2 3 4 5 6 7 8 9 very typical

Strategy 4: I usually study or spend my time on only those topics that I don't know. If I'm satisfied with my knowledge of an area, I let it go; if I'm unsatisfied, I study it well.

not at all typical 1 2 3 4 5 6 7 8 9 very typical

Strategy 5: I usually study everything that is recommended by the course instructor. I will typically read all the assigned material for a course, and often read further in order to really understand the subject.

not at all typical 1 2 3 4 5 6 7 8 9 very typical

My usual strategy is most like Strategy Number (circle one):

1 2 3 4 5

APPENDIX D
FORM B OF STRATEGY QUESTIONNAIRE

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APPENDIX D
FORM B OF STRATEGY QUESTIONNAIRE

At the beginning of the course, you were asked to respond to a questionnaire about your typical strategy in meeting course requirements. This questionnaire is very similar; however, you are now asked to rate yourself on each of the 5 strategies shown below, as to how they describe the strategy you used **in this course**. Read each carefully and respond honestly by circling the number of your choice on each scale. Your responses have no bearing on your course evaluation.

Strategy 1: I usually put off all studying and/or course work as long as possible. I seemed to work more efficiently when the "pressure was on" to meet an upcoming deadline. I usually procrastinated.

not at all typical 1 2 3 4 5 6 7 8 9 very typical

Strategy 2: I usually completed my coursework at a steady, consistent rate. I felt a commitment to work steadily week after week so that I never got behind.

not at all typical 1 2 3 4 5 6 7 8 9 very typical

Strategy 3: I usually studied or spent my time on only those course topics which were of interest to me. I usually did not study that material which was not of interest to me.

not at all typical 1 2 3 4 5 6 7 8 9 very typical

Strategy 4: I usually studied and spent my time on only those topics that I didn't know. If I was satisfied with my knowledge of a module, I let it go; if I was not satisfied, I studied it well.

not at all typical 1 2 3 4 5 6 7 8 9 very typical

Strategy 5: I usually studied everything that was recommended. I read all the primary references and often read the secondary and alternative references in order to really understand the subject.

not at all typical 1 2 3 4 5 6 7 8 9 very typical

MY STRATEGY IN THIS COURSE WAS MOST LIKE STRATEGY NUMBER (circle one)

1 2 3 4 5

APPENDIX E
THE FIVE ITEM STAI A-STATE SCALE

APPENDIX E
THE FIVE ITEM STAI A-STATE SCALE

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the response which describes how you felt on the test you just took. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you felt.

	Not at all	Somewhat	Moderately so	Very much so
1. I was tense	1	2	3	4
2. I felt at ease	1	2	3	4
3. I was relaxed	1	2	3	4
4. I was jittery	1	2	3	4
5. I felt calm	1	2	3	4

APPENDIX F
STUDENT ATTITUDE TOWARD COMPUTER-MANAGED INSTRUCTION

APPENDIX F
STUDENT ATTITUDE TOWARD COMPUTER-MANAGED INSTRUCTION

Developed by Bobby R. Brown

This is not a test of information; therefore, there is no one "right" answer to a question. We are interested in your opinion on each of the statements below. Your opinions will be strictly confidential. Do not hesitate to put down exactly how you feel about each item. We are seeking information, not compliments; please be frank.

Name:_____ Date:_____

Name of Course:_____ Student Number_____

CIRCLE THE RESPONSE THAT MOST NEARLY REPRESENTS YOUR REACTION TO EACH OF THE STATEMENTS BELOW:

1. While taking Computer-Managed Instruction I felt challenged to do my best work.

   Strongly Disagree | Disagree | Uncertain | Agree | Strongly Agree

2. The material presented to me by Computer-Managed Instruction caused me to feel that no one really cared whether I learned or not.

   Strongly Disagree | Disagree | Uncertain | Agree | Strongly Agree

3. The method by which I was told whether I had given a right or wrong answer became monotonous.

   Strongly Disagree | Disagree | Uncertain | Agree | Strongly Agree

4. I was concerned that I might not be understanding the material.

   Strongly Disagree | Disagree | Uncertain | Agree | Strongly Agree

5. I was not concerned when I missed a question because no one was watching me anyway.

   Strongly Disagree | Disagree | Uncertain | Agree | Strongly Agree

6. While taking Computer-Managed Instruction I felt isolated and alone.

All the time	Most of the time	Some of the time	Only occasionally	Never

7. While taking Computer-Managed Instruction I felt as if someone were engaged in conversation with me.

All the time	Most of the time	Some of the time	Only occasionally	Never

8. The responses to my answers seemed appropriate.

All the time	Most of the time	Some of the time	Only occasionally	Never

9. I felt uncertain as to my performance in the programmed course relative to the performance of others.

All the time	Most of the time	Some of the time	Only occasionally	Never

10. I found myself just trying to get through the material rather than trying to learn.

All the time	Most of the time	Some of the time	Only occasionally	Never

11. I knew whether my answers were correct or not before I was told.

Quite Often	Often	Occasionally	Seldom	Very Seldom

12. I guessed at the answers to questions.

Quite Often	Often	Occasionally	Seldom	Very Seldom

13. In a situation where I am trying to learn something, it is important to me to know where I stand relative to others.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

14. I was encouraged by the responses given to my answers of questions.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

15. As a result of having studied some material by Computer-Managed Instruction, I am interested in trying to find out more about the subject matter.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

16. In view of the time allowed for learning, I felt too much material was presented.

All the time	Most of the time	Some of the time	Only occasionally	Never

17. I was more involved in running the machine than in understanding the material.

All the time	Most of the time	Some of the time	Only occasionally	Never

18. I felt I could work at my own pace with Computer-Managed Instruction.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

19. Computer-Managed Instruction makes the learning too mechanical.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

20. I felt as if I had a private tutor while on Computer-Managed Instruction.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

21. I was aware of efforts to suit the material specifically to me.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

22. I found it difficult to concentrate on the course material because of the hardware.

All the time	Most of the time	Some of the time	Only occasionally	Never

23. The Computer-Managed Instruction situation made me feel quite tense.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

24. Questions were asked which I felt were not relevant to the material presented.

All the time	Most of the time	Some of the time	Only occasionally	Never

25. Computer-Managed Instruction is an inefficient use of the student's time.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

26. I put answers in knowing they were wrong in order to get information from the machine.

Quite Often	Often	Occasionally	Seldom	Very Seldom

27. Concerning the course material I took by Computer-Managed Instruction, my feeling toward the material before I came to Computer-Managed Instruction was:

Very favorable	Favorable	Indifferent	Unfavorable	Very unfavorable

28. Concerning the course material I took by Computer-Managed Instruction, my feeling toward the material after I came to Computer-Managed Instruction is:

Very favorable	Favorable	Indifferent	Unfavorable	Very unfavorable

29. I was given answers but still did not understand the questions.

Very often	Often	Occasionally	Seldom	Very Seldom

30. While on Computer-Managed Instruction I encountered mechanical malfunctions.

Very often	Often	Occasionally	Seldom	Very Seldom

31. Computer-Managed Instruction made it possible for me to learn quickly.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

32. I felt frustrated by the Computer-Managed Instruction situation.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

33. The responses to my answers seemed to take into account the difficulty of the question.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

34. I could have learned more if I hadn't felt pushed.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

35. The Computer-Managed Instruction approach is inflexible.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

36. Even otherwise interesting material would be boring when presented by Computer-Managed Instruction.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

37. In view of the effort I put into it, I was satisfied with what I learned while taking Computer-Managed Instruction.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

38. In view of the amount I learned, I would say Computer-Managed Instruction is superior to traditional instruction.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

39. With a course such as I took by Computer-Managed Instruction, I would prefer Computer-Managed Instruction to traditional instruction.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

40. I am not in favor of Computer-Managed Instruction because it is just another step toward de-personalized instruction.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

APPENDIX G
RESULTS OF PACING BY PLACEMENT ANALYSIS FOR ANXIETY AND ATTITUDE DATA

APPENDIX G
RESULTS OF PACING BY PLACEMENT ANALYSES

FOR ANXIETY AND ATTITUDE DATA

TABLE 50

Pacing by Placement ANOVA,
2 x 3, for ANX-I Data

Source	df	MS	F
A (pacing)	1	.74	.04
B (placement)	2	1.47	.08
AB	2	3.93	.21
ERROR	110	18.88	

TABLE 51

Pacing by Placement ANOVA,
2 x 4 for ANX-II Data

Source	df	MS	F
A (pacing)	1	55.72	3.14
B (placement	3	5.82	.33
AB	3	28.51	1.61
ERROR	108	17.74	

TABLE 52

Pacing by Placement ANOVA,
2 x 3 for ATT-I Data

Source	df	MS	F
A (pacing)	1	143.38	.32
B (placement)	2	1089.22	2.46
AB	2	444.10	1.00
ERROR	110	443.15	

TABLE 53

Pacing by Placement ANOVA,
2 x 4 for ATT-II Data

Source	df	MS	F
A (pacing)	1	8.77	.02
B (placement)	3	1337.26	2.82
AB	3	389.16	.82
ERROR	108	474.41	

VITA

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ACADEMIC HISTORY:

B.S., Psychology, Fordham University, New York, 1963

M.S., Guidance and Counseling, Florida State University, Tallahassee, Florida, 1968

Ph.D., Educational Research, Florida State University, Tallahassee, Florida (degree expected, August, 1971)

PROFESSIONAL EXPERIENCE:

June 1970-to date: Data Management Systems Coordinator, CAI Center, Florida State University. In this position acted as communications interface between the user and the Computer Operations Supervisor. Also, instructed users in the data analysis capabilities of the CAI system and acted as trouble- shooter for solving errors and other problems concerning data analysis.

September 1969-to date: Graduate Research Assistant, CAI Center, Florida State University. Involved in individual and team research concerned with instructional systems and automated testing. Design experiments, collect and analyze data, and report results. Have also participated in proposal writing.

September 1968-August 1969: Participant in a year-long institute in Computer-Assisted Instruction at Florida State University. This institute involved in-depth instruction and participation in educational technology, computer-assisted instruction, computer-managed instruction, programmed instruction, and programming languages.

August 1967: Following comprehensive testing and interviews, was accepted as a Management Intern within the Federal Government; turned down all opportunities in favor of graduate school.

August 1963-August 1967: Personnel Officer-Air Force, highest rank-Captain. Principal duties involved directing all activities of the Personal Affairs Office. This included counselling military personnel and dependents on overseas travel, housing, education, insurance, finances, and survivor benefits. Developed a program to bring health care and special education to military dependents with physical and/or mental disabilities. Responsible for processing personnel for overseas assignments. Directed all casualty reporting and personally notified the next of kin in case of casualties. Served as president of the Junior Officer's Council at Moody Air Force Base Georgia.

PUBLICATIONS:

Dunn, T. G., & Hansen, D. N., Effects of prior knowledge of program evaluation and review technique on matching paragraphs to these graphic networks. Paper presented at the meeting of the American Educational Research Association, Minneapolis, Minnesota, 1970.

Dunn, T. G., Lushene, R. E., & O'Neil, Jr., H. F., The complete automation of the Minnesota Multiphasic Personality Inventory and a study of its response latencies. Technical Memo No. 28, CAI Center, Florida State University, 1971. Paper presented at the meeting of the American Educational Research Association, New York, 1971.

Lushene, R. L., Dunn, T. G., & O'Neil, Jr., H. F., The affective nature of computer-based personality testing procedures. Submitted to the American Psychological Association Convention, Washington, D.C., 1971.